

February 2023

MBTA BUS NETWORK REDESIGN

Final Report



massDOT
Massachusetts Department of Transportation



Massachusetts Bay
Transportation Authority

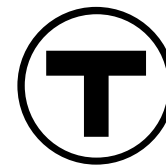
Better
Bus
Project
Making transit
better together

MBTA Bus Network Redesign

Executive Summary



WHY REDESIGN THE NETWORK?



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WE'VE HEARD FROM OUR RIDERS AND THE PUBLIC:

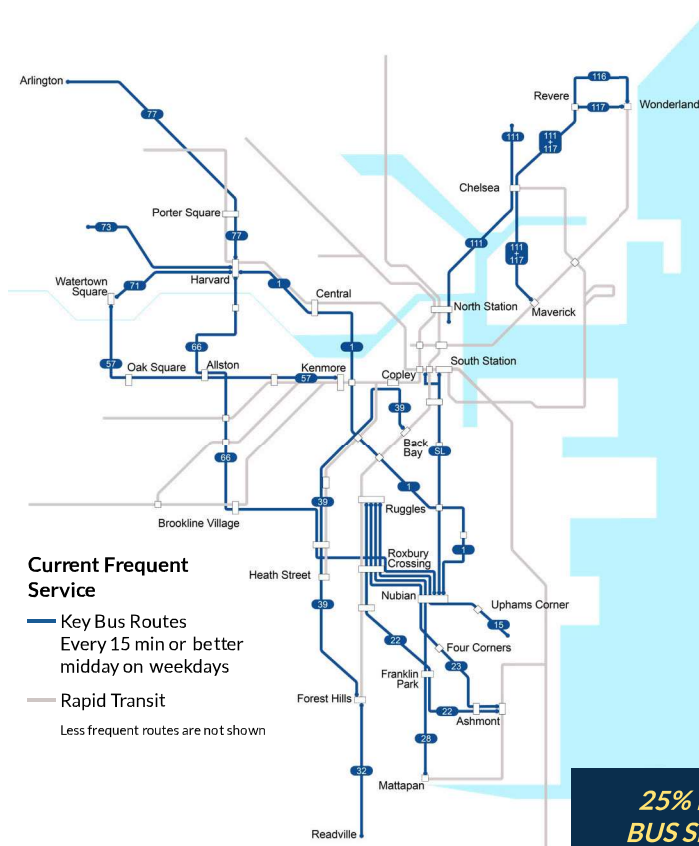
The region has changed. But our bus network has not changed with it. Transit is essential to the region's economy. And the bus serves our most transit-dependent populations.

However, there isn't enough frequent service when people need it, and the network is difficult to understand due to route variations/deviations.

SO IT'S ESSENTIAL THAT OUR BUS NETWORK CHANGES

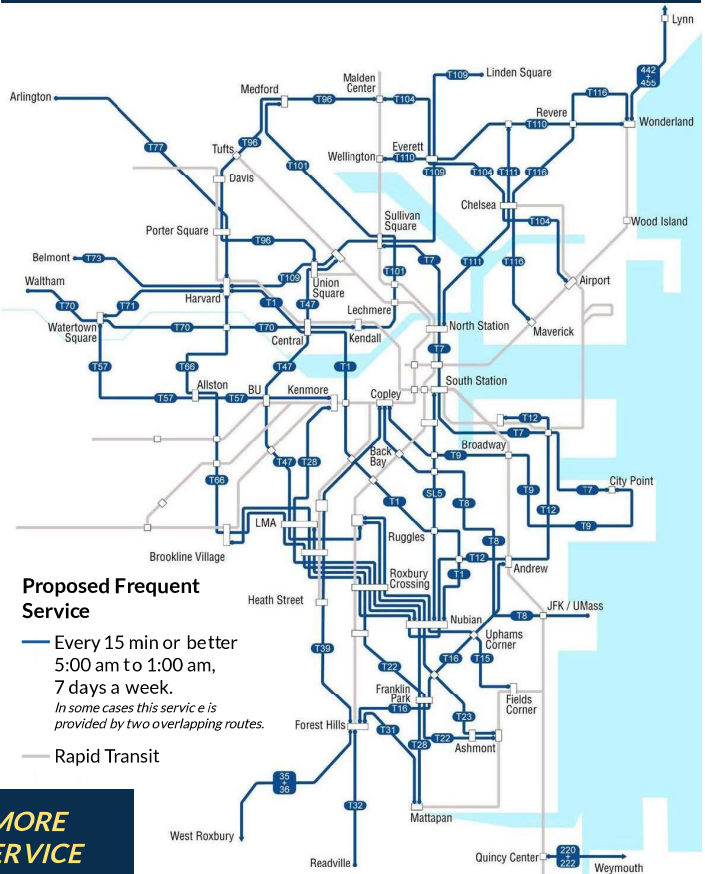
The **BUS NETWORK REDESIGN (BNRD)** is an initiative of the Better Bus Project (BBP). BBP is part of the \$9.6 billion, 5-year capital investment plan to improve bus service. BBP projects include bus stop improvements and station renovations, fleet and facility improvements, bus service improvements like transit priority and operations enhancements, modernized fare collection and passenger information, and improved accessibility of the entire system.

CURRENT HIGH FREQUENCY NETWORK



Only frequent service shown

NEW HIGH FREQUENCY NETWORK



**25% MORE
BUS SERVICE
across the network**



CAPTURING PUBLIC FEEDBACK THROUGHOUT THE BNRD PROCESS

20,000+ PUBLIC COMMENTS RECEIVED

MEETINGS AND EVENTS:



85+ meetings with
**25+ municipalities
and agencies**

40+ meetings with
elected officials

45+ community group
meetings and focus groups

15 External
Task Force meetings

23 open houses/
community meetings

Comments from **135+**
**bus operators and MBTA
operations team**

3 public hearings

15 street teams

13 coffee hours

MATERIALS:



35 neighborhood
fact sheets available
in **9** languages

BNRD website:
mbta.com/BNRD

30 email blasts with
project announcements

65+ social
media posts

Online feedback form
and travel survey

30 newspaper ads

75+ digital
billboards

Digital signs in
**MBTA stations
throughout the system**

Posters and
announcements **on buses
throughout system**

FEEDBACK RECEIVED THROUGH:



16,000+ online
feedback form comments

850+ emails

225+ voicemails

1,400+ comments at
community meetings and
public hearings

1,700
travel survey responses

750+
comment form responses

500 comments
from open houses
and street chats

8 petitions with
2,500+ signatures

This feedback was incorporated directly into the design – including changes to 85 of the 133 routes between the draft and final version.



BUS RIDERS HAVE TOLD US WHAT IMPROVEMENTS ARE MOST IMPORTANT TO THEM – AND WE LISTENED.

Based on input from a wide range of riders and potential riders, the Bus Network was focused on **six goals** that ensure that the bus system gets people where they want to go quickly and reliably.



GOALS FOR THE REDESIGNED NETWORK



1

Equity first*, prioritizing the needs of those who depend on buses and need frequent, reliable service



2

More frequent service in busy neighborhoods



3

More all-day service



4

New connections to more places (including non-downtown centers)



5

A network that's simpler and easier to use



6

More transit priority and other infrastructure to improve reliability and accessibility

* *Equity is defined as improving access and quality of service for transit-critical populations*

(low-income populations, people of color, seniors, people with disabilities, or people who live in households with few or no vehicles)

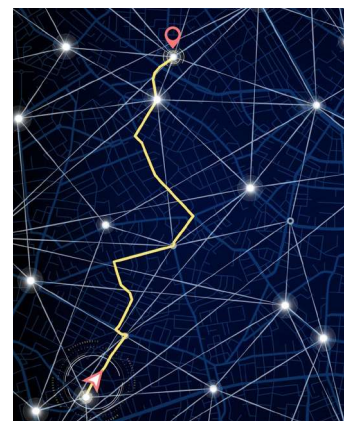


DATA INFORMING THE DESIGN

Meeting the goals outlined above requires a detailed understanding of where and when people travel. **LOCATION-BASED SERVICES (LBS)** data from cell phones is anonymized and unlinked from identifying information. This data helped design the new bus network by:

- Identifying the trips people are making on **all modes** (not just transit) all week to know where there is an **opportunity for bus to move people efficiently**.
- Focusing on the types, locations, and times-of-day of trips made by low-income residents, people of color, and people in zero and low vehicle households. This helps identify where there is **the most need for bus service**.

Data-driven design allowed the MBTA to increase service where and when riders need it the most.



Better
Bus
Project



A BETTER NETWORK FOR THE BOSTON REGION:

25% MORE BUS SERVICE ACROSS THE NETWORK RESULTS IN:



1

125,000 more low-income households and residents of color served by high-frequency service



2

BNRD doubles the number of high frequency corridors with buses every 15-minutes or better, all-day, 7 days a week



3

31% increase in high-frequency service on weekends



4

Neighborhoods, employment districts, and medical, educational, and cultural centers receive new all-day high-frequency routes



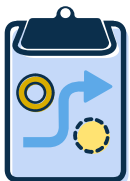
5

More routes have consistent service throughout the week with fewer variations and deviations



6

Implementation Plan prioritizes infrastructure for bus service quality and reliability



FROM PLANNING TO IMPLEMENTATION

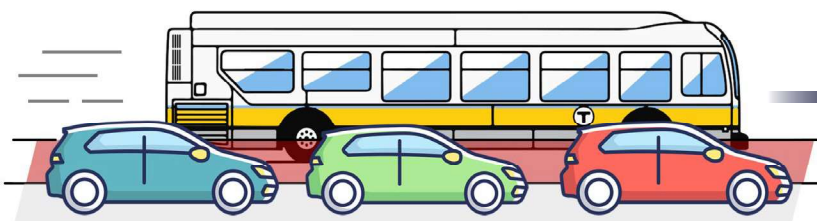
Implementation will be completed over a five-year period. Route changes will be prioritized for implementation based on coordination with the MBTA's municipal partners, internal capital planning, and operator headcount. This will ensure that route changes benefit from supportive infrastructure changes that maximize operational improvement.

Secure capital and operating funding

Hire operators and support staff

Work with municipal partners

Build supportive infrastructure



Implementation Considerations:

1. Bus operator shortage
2. Delivering transit priority projects
3. Fleet and facilities program
4. Develop a 5-year phasing plan



Better
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Project

Acknowledgments

This study was conducted as a joint effort by the Massachusetts Department of Transportation (MassDOT)'s Office of Transportation Planning and the Massachusetts Bay Transportation Authority (MBTA).

This project purposefully engaged a diverse cross-section of departments and teams to achieve the best possible outcome for MBTA bus riders. The below list is an attempt to capture the breadth of collaboration conducted over the course of this project, and to express gratitude to those who dedicated their time and effort to shaping the approach and outcomes of Bus Network Redesign.

- MassDOT and MBTA Leadership
- MassDOT Office of Transportation Planning
- MassDOT / MBTA Office of Performance Management and Innovation
- MBTA Office of the General Manager
- MBTA Bus Operations
- MBTA Bus Transformation
- MBTA Capital Programs
- MBTA Customer Experience
- MBTA Customer Technology Division
- MBTA Office of the Chief Engineer
- MBTA Safety
- MBTA Service Planning
- MBTA Systemwide Accessibility
- MBTA Training School
- Local 589 Leadership

The project team offers deep appreciation to MBTA bus operators, particularly those who provided the project team with countless essential insights in drafting and finalizing the bus network map.

Many city and town staff members from across the MBTA service area were involved in the Bus Network Redesign process, and a special thank you should be extended to municipalities for repeatedly engaging with the project team, supporting public engagement efforts, and inviting project team staff to events, hearings, and outreach opportunities.

This project also benefited from collaboration with external partners, including the Bus Network Redesign External Task Force, whose efforts shaped stakeholder outreach and engagement.

MassDOT contracted the following project team to support this effort: Cambridge Systematics, Inc. in partnership with Regina Villa Associates, Arup, and Marlene Connor Associates. MassDOT also appreciates the efforts of Huitt-Zollars, Inc. throughout the project.

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1

The MBTA's Current Bus Network and Why It Needs to Change

History

The MBTA's bus network has experienced very few changes over time. The current network map looks very similar to a map of the streetcar network from the 1920s. When buses began to replace streetcars in the 1950s and 1960s, they continued to operate along those routes. While many of these streetcar routes still serve important and popular travel locations, the network's ties to historic patterns do not meet the full range of today's travel needs.

The Changing Region

While the bus network has largely stayed the same, the Greater Boston area has experienced significant changes. The current bus network—like the historic streetcar network it mirrors—has largely focused on serving the downtown area due to its traditional status as a center of economic activity. But new employment districts have emerged—both within and outside of Boston. The change in regional growth patterns have led to shifting demographics, increased congestion, and different travel behaviors.



Boston population

7% increase
from 2012 to 2017



Households owning vehicles

15% increase
from 2012 to 2017



The average trip during peak hours took

20% longer

In 2019 than it did in 2006

Traveling between residential areas and employment districts outside of Boston's Central Business District represents a different travel pattern than what the bus network is structured to serve, meaning transit has been less competitive for workers during peak-hour commuting and more people have chosen to travel by car. Employment growth in several sectors with all-day operations and off-peak shifts, such as logistics, health care, and dining and hospitality, have resulted in higher levels of travel demand at all times of day—not just the peak-hour commute patterns of 9am to 5pm that underlie many of the schedules for peak-hour service.

At the same time, population in the city of Boston and the metropolitan region has steadily increased, putting a growing number of cars on Boston-area roads and increasing congestion.

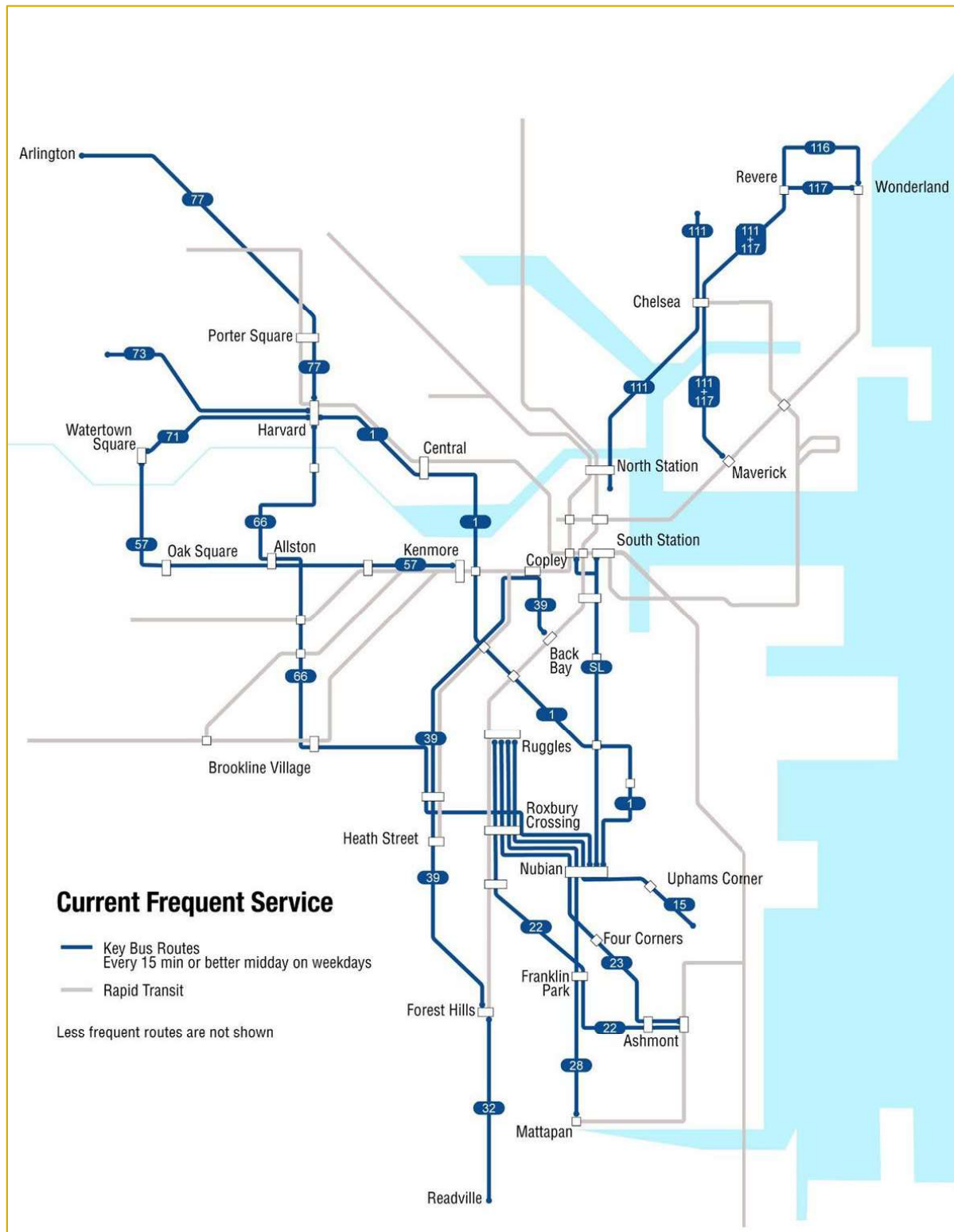
Many of these changes have accelerated during the COVID-19 pandemic, when an increase in remote work, growth in home delivery services, and ongoing staffing challenges in essential industries created numerous disruptions in the transportation network that are still being felt today. While rush-hour traffic decreased in the early days of the pandemic as offices remained closed, peak-hour traffic levels are now back to their pre-COVID levels, and traffic congestion is spread out over a longer period of time, causing travel delays throughout the day.

Despite the drastic changes of the COVID era, the bus has remained an essential form of regional mobility. During the pandemic, the bus network retained more than four times its share of ridership than the commuter rail or the ferry system. Many MBTA bus riders are lower-income, people of color, seniors, or people who live in households with no vehicles. Many riders who belong to these demographics are also employed as essential workers—the staff in health care, food and hospitality, warehousing and logistics, and other critical services that kept the Boston metropolitan area safe, secure, and healthy before, during, and after the pandemic.

To address these issues, the MBTA initiated the **Bus Network Redesign (BNRD)** to assess and update the bus network in order to better meet the travel needs of the region.

The Current Network's Performance

Figure 1 Frequent Service in the Current Bus Network



The MBTA bus network reaches nearly 1.9 million residents in the Greater Boston area, providing over 100 million trips annually in the pre-COVID era. More than one-third of all MBTA trips were provided by these buses. To assess the performance of the network for the Bus Network Redesign, the MBTA identified two key metrics: coverage, and vehicle revenue miles. Coverage represents the percentage of the Greater Boston area population that lives within ¼-mile of a bus route. Vehicle revenue miles represents the total number of miles of bus service provided on a weekly basis.

These metrics were applied to the three main service profiles in the bus network: service that operates five days per week (Weekday), service that operates six days per week (Saturday), and service that operates seven days per week (Sunday). Additionally, these metrics were applied to the high-frequency service provided in each profile, which is defined as service that runs at least every 15 minutes. The network-wide performance for these metrics is presented in Table 1.

Table 1 MBTA Bus Network Performance, by Service Profile

Metric	Weekday	Weekday Frequent Service	Saturday	Saturday Frequent Service	Sunday	Sunday Frequent Service
Coverage	73.5%	35.4%	69.0%	28.3%	64.6%	23.3%
Vehicle Revenue Miles (Weekly)	454,032	68,852	284,538	55,653	197,657	45,004

These metrics point to significant gaps in the current network structure, with drastic decreases in access to high-frequency service throughout the Boston metropolitan area on all days of the week. This issue is particularly acute on the weekends, when coverage for high-frequency service drops by over 40 percentage points compared to coverage for overall service. This decrease demonstrates how much of the Boston metropolitan population is unable to use service that is readily available and how transit struggles to be competitive with other mobility options.

The network is also marked by significant variation in performance at the neighborhood level. While the entirety of Boston has weekday coverage greater than 95 percent, high-frequency coverage drops below 66 percent in East Boston, Roslindale, and Hyde Park, among other neighborhoods. Similarly, Boston metropolitan communities demonstrate a wide range of performance. Inner Boston suburbs, including Cambridge, Revere, and Charlestown have coverage levels that exceed 95 percent, but coverage declines precipitously further out in the region. Communities including Salem, Lynnfield, and

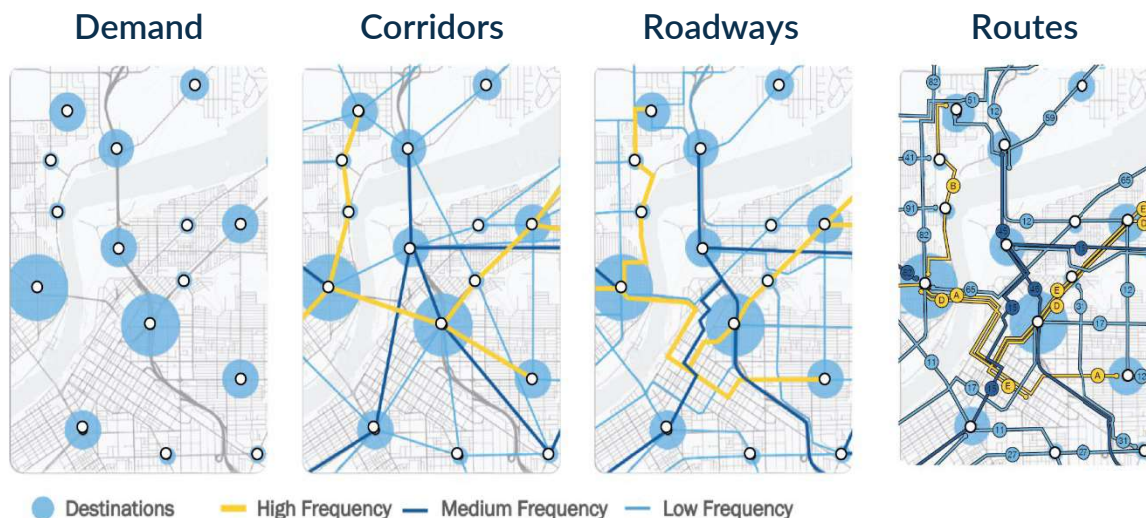
Burlington have weekday coverage rates in the mid-50s, while others, such as Dedham and Canton, drop below 40 percent.

Why the MBTA is Redesigning the Network

The Bus Network Redesign is a complete reimagining of the MBTA's bus network to better reflect the travel needs of the region and to create a better experience for current and future bus riders.

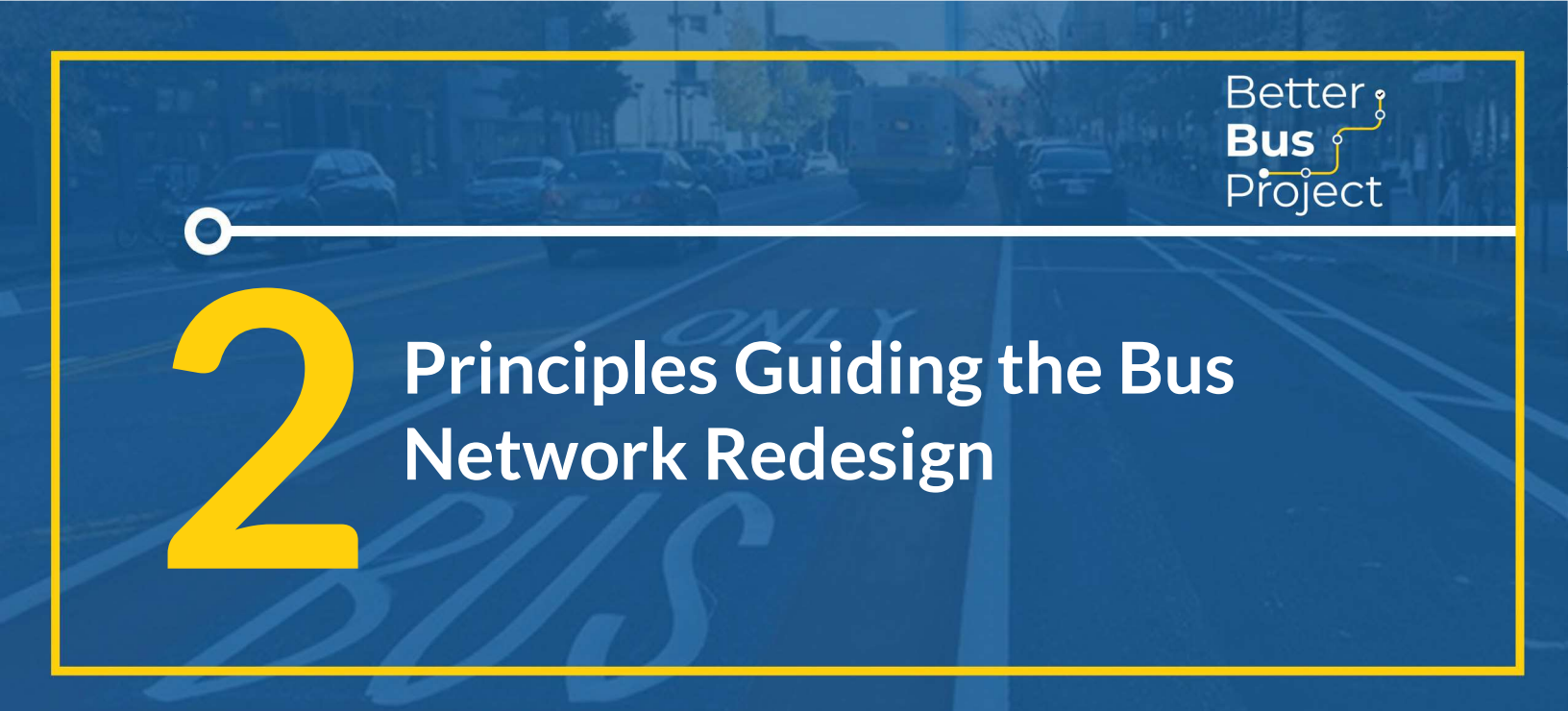
In Better Bus Project outreach, riders said the bus network is infrequent, unreliable, slow, indirect, and overly-focused on peak-hour service. In short, they told us that **the current network does not work for riders**. Making adjustments to individual routes is not sufficient to achieve the service improvements that the MBTA wants to see for current and future riders—anything that makes changes to the existing network reinforces the overall structure of the current network.

By undertaking a comprehensive redesign, the MBTA has the opportunity to address these concerns, assess service performance, and reassign and increase resources throughout the network. A network redesign allows for a “blank-slate” approach to identifying where, how, and when people want to travel. Starting with an analysis of travel demand, the MBTA has identified key corridors for travel, roadways that accommodate bus operations, and routes that promote safe, efficient, and reliable bus service, with a high-frequency network serving as the backbone for the entire bus system.



Throughout this effort, the input and feedback of riders has been critical, helping the MBTA to embed a rider's perspective in each decision, from the identification of key local destinations to the consideration of accessibility issues in proposed route design.

These efforts build on the MBTA's ongoing initiatives to improve bus service through operational enhancements and capital investment. Using the Better Bus Project as a base, BNRD is aligned with other important efforts, including the Bus Stop Accessibility Improvements program, the Bus Transit Priority program, and the Bus Facility Modernization program to ensure that new routes are rolled out with supportive infrastructure, including priority bus lanes, more visible crosswalks, and improved bus staging areas. At the same time, the redesigned routes will direct the other efforts to deploy new infrastructure along the key travel corridors and in the areas where people want to access bus service. Coordination across these initiatives will ensure that the MBTA maximizes the effectiveness of its investments and delivers meaningful improvements in service performance and rider experience.

The background of the top section is a blue-tinted photograph of a city street. A white circle with a horizontal line extends from it on the left. The street has a 'BUS ONLY' lane marked with white text and arrows. A yellow number '2' is positioned to the left of the main title.

2 Principles Guiding the Bus Network Redesign

Project Goals

As part of the project, the MBTA established a series of six goals for the Bus Network Redesign:

- Equity First
- More frequent service in busy neighborhoods
- More all-day service
- New connections to more places
- A network that's simpler and easier to use
- Improvements to reliability and accessibility

These goals represent the desired outcomes of the BNRD process and were used as the framework for the design of the new network, planning and policy decisions, and how success the benefits of the new network were measured.

Equity First

Equity is the primary driver for the Bus Network Redesign. From the beginning, the MBTA set out to provide more service and more reliable service to the people most dependent on transit to improve access to opportunities. Transit-critical populations are more likely to ride and rely on transit—making them the system’s most reliable users. But they also have preferences and needs that are different from the standard “9-to-5” commute that has historically informed much of the MBTA’s service planning: they make multiple trips while riding transit, they use transit throughout the day, and they travel to non-Downtown destinations. Meeting the needs of transit-critical populations therefore meant taking a hard look at how the MBTA’s routes are structured, where they go, and how service is distributed throughout the day.

Great bus service...



Serves the people who
need it the most

Equity is defined as improving access and quality of service for transit-critical populations: low-income populations, people of color, seniors, people with disabilities, or people who live in households with few or no vehicles.

More Frequent Service in Busy Neighborhoods

The MBTA wanted to ensure that the new bus network would provide the most service in areas where people wanted to go, serving places that generate high levels of activity. These areas of high demand—both those that are historic parts of the network and those that have emerged as newer travel areas—were then prioritized for receiving high-frequency service under the new network. Frequency has a major impact on the usability of the bus system by decreasing the amount of time customers spend waiting for the bus and allowing them to travel further across the region in the same amount of time. A network of connected high-frequency service has the added benefit of making transfers between routes faster and easier, exponentially increasing where a customer can travel in a reasonable amount of time.

Great bus service...



Is fast, frequent, and
reliable

Wait time (both initial wait time and time spent waiting for a transfer) is generally viewed as the most unpleasant part of a transit trip—especially when the wait is at a bus stop that has few amenities for customer comfort or security, such as benches or shelters. Longer wait times add to this stress by creating uncertainty and raising the risk for customers—if a customer misses the first bus, they may miss their medical appointment or the start of their work day. By reducing wait time with more frequent service, the MBTA will improve the customer experience and improve service reliability, making the bus a more competitive travel choice for customers.

High-frequency service: a bus stopping at your stop every 15 minutes or better all day, seven days per week.

More All-Day Service

The MBTA wanted to provide more consistent service across the week, including weekends and all times of day. The MBTA understands that riders travel at all times of day in order to fulfill a wide variety of trip needs, not just the traditional peak periods determined by 9-to-5 commutes. Serving the MBTA customer's full spectrum of needs—from night classes to medical appointments—is all the more important in a post-COVID environment, where travel demand has been spread out throughout the day, meaning there is less difference between peak-period and off-peak demand.

Ridership during the pandemic has been less focused on the traditional peak times around 8 AM and 5 PM on weekdays and more focused on off-peak travel. These new travel patterns merit a new network that better serves all trip types throughout the day.

To serve these trips better, the MBTA has increased midday, evening, and weekend service to align service with demand. Sometimes, this has required the MBTA to reduce peak-hour service frequency in order to better balance resources.

New Connections to More Places

The Greater Boston region has changed over the years, and there has been a significant growth in jobs and activity centers outside of the urban downtown that was the focus of the existing bus network. Providing more frequent and more direct connections to these employment and activity centers will ensure that the MBTA bus network continues to meet the travel needs of all the residents in the region.

Top regional destinations identified through a travel survey and a travel demand dataset include:

- Financial District
- Logan Airport
- Longwood Medical Area
- Chinatown (Boston)
- Fenway/Kenmore
- Government Center
- Beacon Hill/MGH
- Prudential/Copley
- Seaport District
- West End/North Station
- South End/BMC
- Kendall Square
- Lower Roxbury
- Back Bay
- Central Square (Cambridge)
- Harvard Square
- Jackson Square/Mission Hill South
- Upham's Corner (Dorchester)
- Allston/Brighton
- Lechmere (Cambridge)

Great bus service...



Goes where people want to travel, when they need it



A Network That Is Simpler and Easier to Use

The MBTA reduced variation in bus schedules and routes across the time of day and the days of the week to make the system easier for everyone to understand. Removing variations in routing and scheduling means that the service is easier to understand and to learn, making it more approachable to new customers, and more intuitive to navigate for frequent riders.

Great bus service...



Is simple to use and
understand

Improvements to Reliability and Accessibility

The MBTA knows that many current bus stops are not accessible for people with mobility challenges, such as the elderly, people with disabilities, and people traveling with small children. In order for BNRD to maximize benefits to riders, the MBTA will work with the municipal governments in which the MBTA operates to install infrastructure that prioritizes transit movement to strengthen service reliability and improves the accessibility and quality of transit service.

The goal of the Bus Network Redesign is to have buses be consistent and reliable enough that people can show up to a bus stop without having to check the schedule—that they can plan their trips based on a reliable on-time arrival. Transit priority can be achieved through a range of infrastructure solutions at the bus stop and along the bus route. Painted bus lanes and “bump-outs” at bus stops can reduce interference between buses and other vehicles, improving bus travel times and making bus service faster.

Bus stop shelters, lighting, and benches can improve customer comfort and safety while posted schedules make customer information more accessible.

While the specific types of infrastructure will be determined based on local operating conditions for the routes, the Bus Network Redesign established infrastructure improvements as a critical component for successful network transformation, and municipal partnerships are essential for delivering these improvements.

Service Design Principles

Based on feedback from the public and key stakeholders, the MBTA developed a set of Service Design Principles that represent public preferences for how to structure a new transit network:

- Prioritize frequency over one-seat rides
- Create rapid transit connections and maintain crosstown trips
- Focus on all-day service
- Combine routes to create high frequency corridors
- Minimize route variations
- Minimize deviations on high frequency route

These principles highlight how the BNRD goals will be realized through service design.

Prioritize Frequency over One-Seat Rides

The public told us: it is better to have a street with a single frequent route on it rather than multiple infrequent routes. This structure simplifies the network and increases the reliability of the service—if someone misses a bus, they can be confident that another bus will be along soon.

While passengers will may need to transfer from one frequent route to another in order to reach their destination, higher frequency means shorter wait times for those transfers, ultimately reducing total travel time compared to a single-seat ride along a low-frequency route. This may also result in riders having to walk further in order to reach a bus route, but the new network ensures that nearly all existing bus stops will have at least one stop within a quarter mile (approximately 7 minutes walking) in the new network, to ensure that no one has to walk too far.

Create Rapid Transit Connections and Maintain Crosstown Trips

The region's high-capacity transit network of rail and Silver Line service is one of its greatest transit assets, providing fast, frequent connections to many parts of the region. With this infrastructure already in place, the new bus network was designed to provide

connections to the high-capacity transit system but not to duplicate it. This leverages the power of the broader transit network and allows the MBTA to build higher-frequency service in other parts of the region.

The rail system was designed to bring trips into the regional core, and the lines radiate from downtown Boston, with the Silver Line network providing a key rapid transit connection in areas lacking rail coverage. Buses can provide a faster, more direct option for many crosstown trips. The redesigned bus network includes many crosstown routes that connect neighborhoods in more outlying areas, many of which provide connection to and between multiple rail lines.

Focus on All-Day Service

Based on current travel patterns, the redesigned bus network will focus on all-day travel, instead of focusing on the traditional peak periods. As part of BNRD, the MBTA has established a minimum span of service for the network that reflects the post-COVID reality, with buses running from early morning to past midnight. The MBTA has increased its midday, evening, and weekend service, even when that may require reducing peak service in order to better serve riders traveling at all times of day.

Combine Routes to Create High Frequency Corridors

The public told us that they would prefer slightly longer walks to a more frequent bus service, than a shorter walk to less frequent service. This preference has been incorporated into the redesigned bus network by combining multiple infrequent routes into a single higher-frequency route to reduce total travel time and improve reliability. This has resulted in fewer routes on some streets—but not necessarily less service.

These high-frequency corridors will be presented as distinct from the regular bus network—through route nomenclature, on maps, and at bus stops—to signal their higher-quality service to the public and encourage riders to incorporate these routes into their travel.

This principle also enables the MBTA and its municipal partners to optimize investments in bus infrastructure by making infrastructure usable by multiple routes along high-frequency corridors.

Minimize Route Variations

In the Better Bus Project, the MBTA set a policy goal to reduce route variations that create customer confusion, serve few people, and do not impact vulnerable populations who do not have other alternatives. Reducing variation in route design means more consistent spans of service throughout the day and throughout the week, resulting in a network that is easier for people to understand and to plan their trips around. The same philosophy has guided the development of the Bus Network Redesign.

Minimize Deviations on High Frequency Routes

In the Better Bus Project, the MBTA noted that the less a bus needs to turn or deviate from a straight path, the faster it will travel. This makes bus routes easier to understand while also providing faster and more reliable service for the MBTA's customers. In the new network, deviations—places where the bus goes off of the most direct line in order to serve a specific destination—have been avoided on high-frequency routes, except for rapid transit stations and very high volume destinations like hospitals, where many of the riders on the bus will benefit from the short walk rather than be inconvenienced by the longer bus ride.

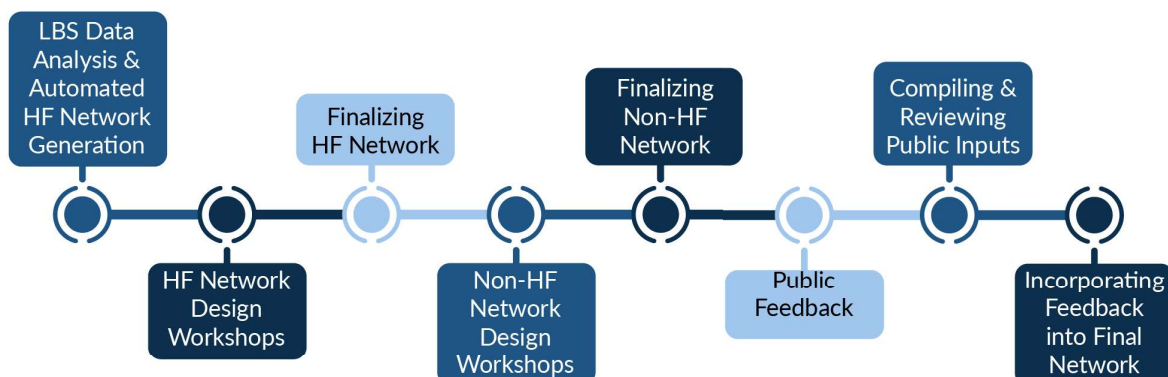
3 A Data-Driven Approach to Designing an Equitable Bus Network

This section describes the process used to design the draft BNRD network consistent with the goals and principles described in Section 2. The process was guided by a combination of analysis of travel market data and knowledge of local conditions, with equity centered in decision-making throughout.

The overall design process consisted of several stages integrating an intensive focus on travel market data, service planners' knowledge, and expertise with local conditions, constraints, and needs. Creating the Draft Network Map for public feedback included five stages, including analysis of location-based services (LBS) data and a systemic process to algorithmically generate high-frequency networks serving that demand; a set of workshops to refine high-frequency (HF) corridors and routes; finalizing the high frequency network; a series of workshops to design the non-high frequency parts of the bus network; and finalizing the complete network.

The process is summarized in Figure 2.

Figure 2 BNRD Data-Driven Process Overview



The public outreach process is described in Section 4, and the process of integrating public feedback into the final map is described in Section 5.

Key Definitions

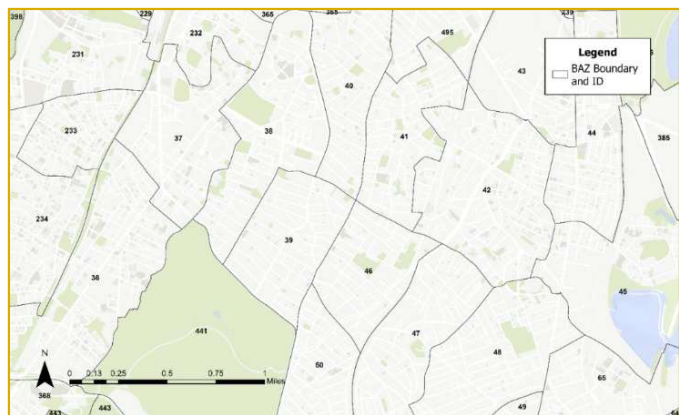
In order to provide a consistent and understandable language around the process described in this section, key terms are defined as follows.

Resource Alternatives

The project team wanted to consider how much of the total bus service should be dedicated to high-frequency service. To test different options, the project team defined high, medium, and low resource alternatives that allocated 80 percent, 60 percent, and 40 percent of bus revenue hours, respectively, to high-frequency service.

Bus Analysis Zone (BAZ)

The service design process considered the entire MBTA bus service area, which covers 51 cities and towns in the Boston region. For the purposes of analysis and service planning, this area was divided into 831 polygons, each roughly 0.5 square miles in area, representing one or more census block groups. These BAZs served as the main geographic reference for analyzing demand; the demand data was aggregated at the BAZ level. Development of corridors was also conducted by linking BAZs across the region. The size was selected to approximate a walkable area from a bus stop, such that any bus stop (or several bus stops) serving anywhere within a BAZ could be assumed to serve the entire BAZ.



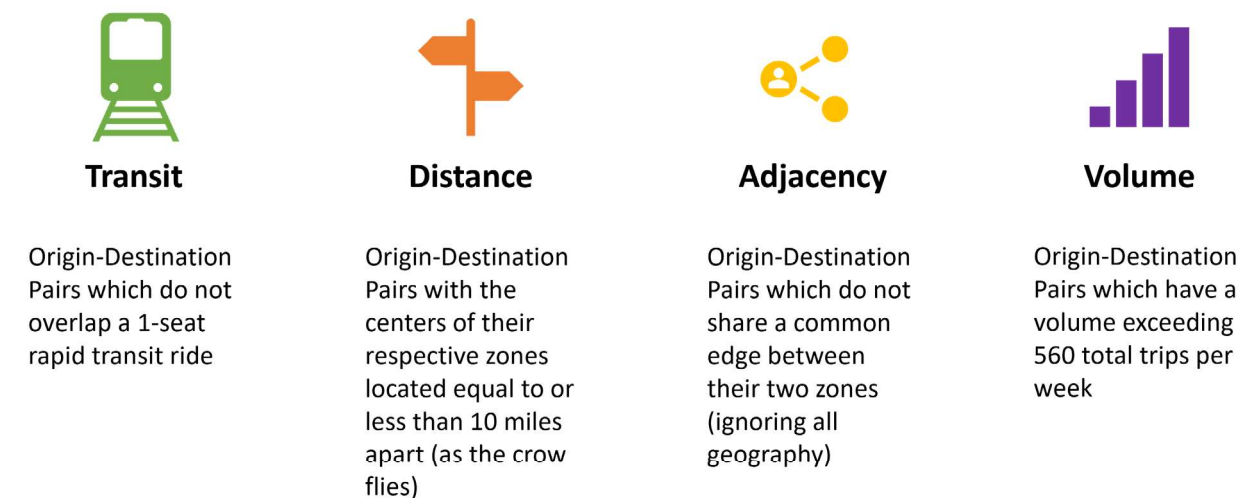
Connection

A connection is a link between an origin and destination BAZ where travel occurs. In the MBTA bus service area, there were 180,000 BAZ-to-BAZ origin-destination (O-D) connections representing nearly 90 million total trips during October 2019. Each connection in this dataset included total trips on all modes including transit, vehicle, pedestrian, and bicycle trips.

Serviceable Connection

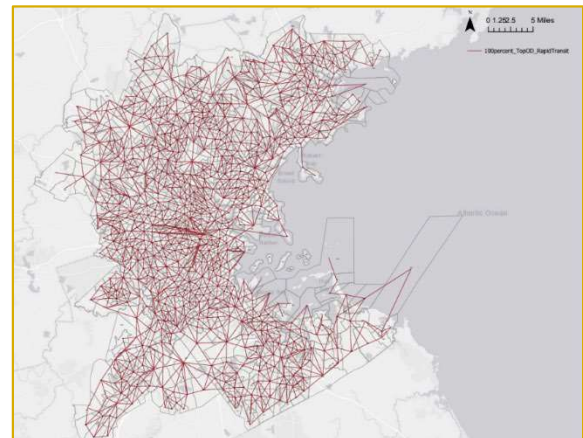
Serviceable Connections were identified as the subset of all connections that bus routes should aim to serve. These serviceable connections were identified using a set of filters. Physical attribute filters ensured that connections were not redundant with one-seat rapid transit service and that they were a reasonable length to be served by bus (determined to be 10 miles or less). Trips within a single BAZ or between two adjacent BAZs were filtered out because they were deemed to be walkable/bikeable. The basic volume filter ensured that the serviceable connections had a high enough level of demand to support at least one bus a day throughout the week in both directions. These filters are illustrated in Figure 3.

Figure 3 Filters Used to Create Serviceable Connections



Busable

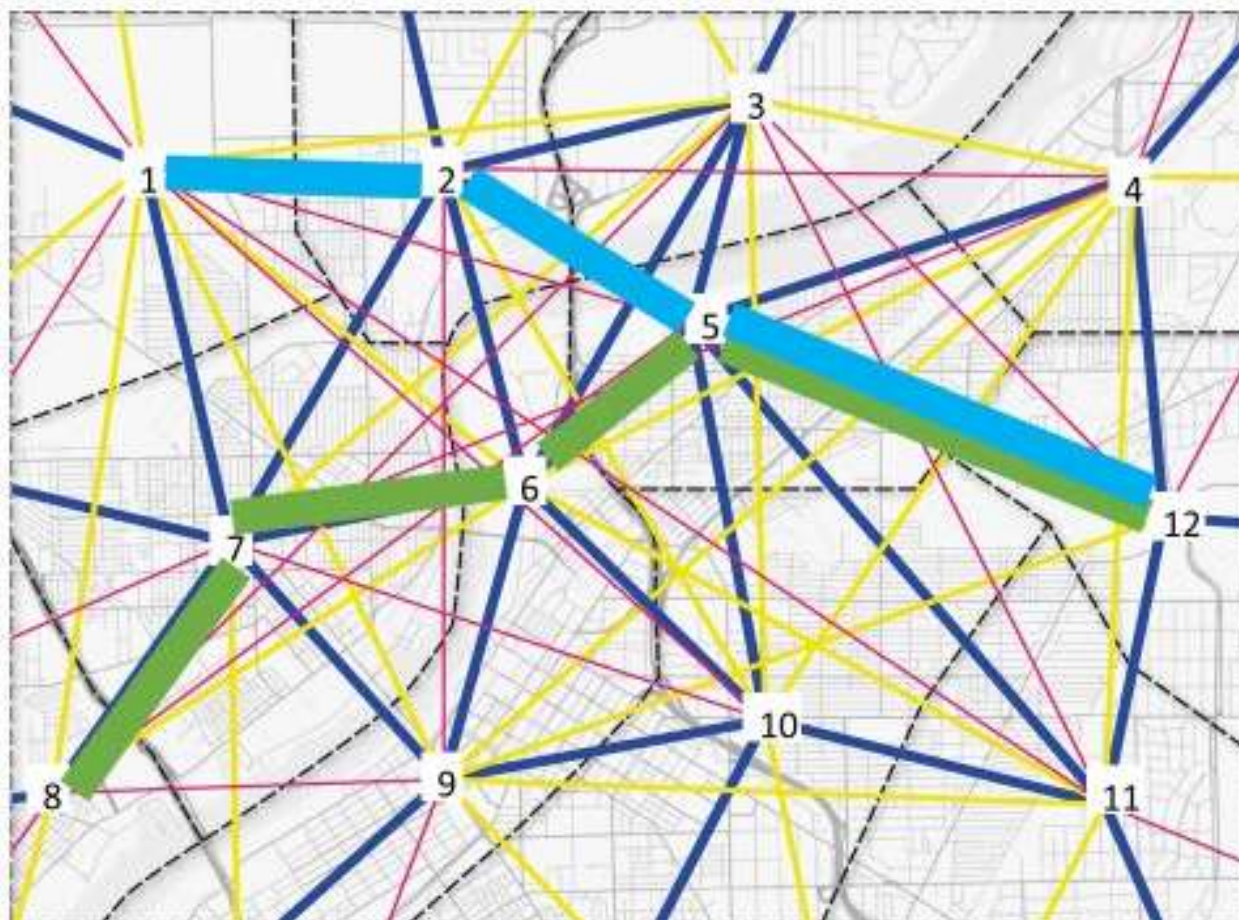
Busable means that there is viable road infrastructure for a bus to use. This can be applied to Busable Streets, which are roads that are of a width and grade that could support a bus in winter conditions. Busable Adjacencies are BAZs that are physically touching (adjacent to) each other and also connected by one or more Busable Streets.



Corridor

A corridor is defined as an ordered string of BAZs linking an origin and destination BAZ. Figure 4 highlights two corridors in a hypothetical geography, with the blue corridor connecting BAZs 1 and 12 using the string [1, 2, 5, 12], and the green corridor connecting BAZs 8 and 12 using the string [8, 7, 6, 5, 12].

Figure 4 Illustration of Corridors in a Hypothetical Geography



Route

A route is a path along a corridor along actual roads with precise distances, resources, and terminal locations.

Network

A network is formed by a collection of routes.

Demand*

*Demand**, or “demand star,” denotes a composite of total trips, trips by low-income travelers, and trips by minority travelers. It weights trips by low-income or minority travelers at 1.5 times the weight of total trips. This underscores the emphasis on equity in the process and recognizes the affinity for transit use by low-income and minority populations.

The Automated Process for Generating High-Frequency Networks

The project team—consisting primarily of staff from MassDOT’s Office of Transportation Planning, the Office of Performance Management and Innovation, MBTA Service Planning, MBTA Bus Transformation, and project consultants Cambridge Systematics and Arup—undertook a data-driven approach to developing a proposed high-frequency route network as part of the BNRD project. This approach was developed to create an objective, repeatable process for analyzing travel data across the Greater Boston region and integrating it with the service planning process. The result is a set of high-frequency networks based on observed travel data that is linked to sociodemographic groups. The high-frequency corridors created by this process were then considered as inputs to a service planning process that incorporated a wide range of data, analytics, and knowledge about existing bus operations.

The process created algorithms that used trip data to form 92,000 potential high-frequency corridors which linked origin and destination locations. These corridors were analyzed and combined into 100,000 different potential networks that were evaluated based on an objective function that prioritized equity and the amount of demand that could be served with a given amount of service. An overview of this process is divided into five steps.

The process was developed to ensure repeatability with future travel data and to center equity from initial exploration through final design. As a process built from demand data, it is a tool that can be used to create and reexamine the high-frequency core of the bus network as travel and development patterns continue to evolve.

Step 1: Organize Travel Demand Data

This process used Location-Based Service (LBS) data comprising approximately 90 million trips made on all transportation modes in the MBTA service area (collected from StreetLight Data, an LBS data provider) in October 2019.

The LBS data was joined with relevant data to denote trips taken by individuals who belong to ethnic minority groups or are from a low-income household, as well as demographic data relevant to MBTA's Title VI Policy population definitions.¹ This method of identifying equity trips captures all the travel made by low income and minority populations, regardless of the starting/ending point of a trip.

Organization of the LBS data included several steps, including connecting it to the BAZ geographies, attaching demographic data, and identifying serviceable connections. After all filters were applied, the universe of serviceable connections contained 13,329 BAZ-to-BAZ connections representing approximately 24 million trips from the original dataset. A breakdown of the effects of each filter is shown in Table 2.

Table 2 Effects of Filtering Travel Data

Data	Filters Applied	Connections (O-D Pairs)	Total Trips	Low-income Trips	Minority Trips
Raw Data	No filters applied	177,439	87,395,799	35,275,742	29,942,689
Clean Workable Data	Intra-BAZ pairs removed	176,608	63,232,985	25,133,061	21,363,911
Physical Attributes Filters	Neighbor BAZ filter, rapid transit overlap filter, distance filter	110,665	34,644,014	13,388,016	11,519,044
Volume Threshold	Trip volume supports at least one bus per day in both directions	13,329	24,154,933	9,612,184	8,352,334

The filtering process allowed for a universe of serviceable origin-destination connections that are both navigable by a bus route from a physical perspective and have enough demand to allow for a minimum level of service (one bus per day). Identifying serviceable connections allowed the design of the high-frequency network to focus on the portion of connections that were best suited to service by buses.

¹ The Title VI Policy is the MBTA's policy established to maintain compliance with Title VI of the Civil Rights Act, which requires that a federally-funded service does not discriminate against any individual receiving the benefit of that service on the basis of race or ethnicity.

Further work to set up the corridor generation process included identifying Busable Streets in the region, using that to determine Busable Adjacencies of BAZs, and identifying the complete web of paths that could be made between each Serviceable Connection in the service area.

Step 2: Generate Corridors

Once busable adjacencies and serviceable connections between BAZs were identified, the next step was to create and evaluate potential high-frequency bus corridors for each connection in the dataset. In a dense network like the Boston region, there are many potential paths that connect each O-D pair, and no guarantee that the shortest or most direct path would actually make the best bus route. This is because the demand served by a corridor is not only the demand between the origin and destination BAZs, but also includes demand between intermediate BAZ pairs. Some diversion from the shortest line may actually be beneficial in bus routing, as this could allow a route to better access hospitals, schools, low-income housing, and other key local assets. Also, irregularities in the Boston area's road network often lead to unlikely and non-intuitive routings being the most effective path.

This was addressed by creating a large number of corridors between each BAZ pair where possible, and identifying the options that most efficiently met the stated goals for the redesign. There were 20 paths generated between each origin and destination BAZ, where possible. A total of approximately 7 million corridors were created in this step.

Step 3: Filter Corridors

The 7 million corridors created in the previous step were too many to carry forward into network design. This step focused on identifying a subset of these corridors that should be analyzed further. Total trip volume served, equity-population trip volume served, distance, and the number of BAZs in each corridor's pathway were identified for each corridor. This data was used to estimate the quantity of resources needed to serve each corridor, as well as scoring of networks during the network design process discussed in Step 5.

The 7 million corridors were filtered by whether they could meet constraints or goals:

- **Physical characteristics:** This filter ensured that each corridor was an appropriate length and shape for bus routes.

- The corridor length was limited to a routed distance between 2 and 15 miles. A length less than 2 miles was considered walkable/bikeable, and thus was unlikely to correspond to a single bus route. A length greater than 15 miles was considered operationally inefficient and unsustainable in an urban network.
- The corridor circuitry was limited to a value of less than 2. The circuitry was calculated for each corridor by dividing the BAZ centroid-to-centroid distance of each pathway by the straight-line distance between the centroids of the origin and destination BAZs. Circuitry was limited to reduce inefficient deviations and needlessly long corridors and focus high-frequency service on corridors that could provide relatively direct and fast travel times.
- The corridors were limited to those that had **at least 3 BAZs** in their pathway.
- **Rapid transit overlap:** This filter removed corridors that were significantly overlapped by any individual rapid transit line in the MBTA system to minimize redundancy with the rapid transit network. Any corridor with greater than 75 percent overlap was removed from the dataset.
- **Significant volume:** For each O-D connection, this filter identified the two corridors that most successfully achieved the service objectives previously defined by the project team. To quantify the objectives of serving total, minority, and low-income demand, a modified demand quantity, referred to as *demand**, was used.

All demand values in this calculation draw upon the serviceable connections demand dataset. Out of the 20 corridors developed for each OD connections, the two corridors with the highest *demand** value were retained. This filter identified not only highly traveled corridors, but also corridors with more value to equity populations. This resulted in a maximum of two corridors for each O-D connection.

- **Volume/mile ratio:** Because demand varies significantly across the region and resources are always limited, an additional filter was applied to prioritize the most resource-efficient corridors. The process calculated the trips served per mile and retained the top third of corridors by total volume/mile from the serviceable connections demand dataset.

The result of the filters was a final set of 92,000 corridors. This process does have the limitation of potentially removing “useful candidate” corridors, but given the resource limitations, these filters do result in creating a large universe to generate networks that cover a significant portion of demand.

Step 4: Assign Corridors to Roadways

At this point, all corridors follow the web of connections linking BAZ centroids to one another based on the busable adjacencies. The analysis in Step 1 of busable adjacencies only identified if there was a busable roadway connection between two BAZs, and it did not identify the preferred roadway for making that connection when multiple options exist. The next step in the process was to map each of the corridors from BAZ pathways to specific roadways. This process was automated using an FME (Feature Manipulation Engine) algorithm to find the shortest path tool on the busable streets network, while prioritizing specific types of roadways that are more suitable to bus service (e.g. arterials were prioritized over freeways).² Sidewalk accessibility, street direction, speed limits, and other factors were not considered at this stage.

The output from this process is a set of 92,000 routes that represent a potential route along the actual busable road network for each corridor. Finalizing routing still required manual review and design from service planners to identify other considerations, such as important locations to serve and distribution of service within BAZs.

Step 5: Corridors to Networks

The next step was to move from individual corridors to sets of corridors that comprise high-frequency networks. Potential networks were evaluated to identify the set of corridors that served the most *demand** while fitting within a resource constraint. Selecting the corridors from the list of 92,000 routed corridors that perform best individually would not necessarily result in a network that equitably and efficiently provides high-frequency service across Greater Boston.

Therefore, to create potential networks, a sampling process was implemented that selected from the list of routed corridors and grouped them to create a large number of possible networks. The process incorporated several variables and assumptions, including:

- **Resources used:** For each routed corridor, an estimate of the resources needed to provide high-frequency service during the peak period was calculated. Agreed-upon assumptions for available resources and service parameters include:

² FME is a data integration tool used for transforming data.

- 2,530,543 vehicle revenue hours (equivalent to the resource hours operated in Spring 2020).³
- 5 percent of revenue hours held in reserve to be treated as “savings” for providing service needs identified through the stakeholder outreach process rather than the travel demand-driven process.
- Headways were assumed to be approximately 11-15 minutes for high-frequency service (HF), 22.5 minutes for medium-frequency service (MF), and 45 minutes for low-frequency service (LF).
- Span of Service for bus service was defined as at least 6am–12 midnight on weekdays and Saturdays; at least 7am–12 midnight on Sundays.
- Travel speed of MBTA buses were assumed to average 12 mph (scheduled, recognizing that local traffic conditions can impact actual travel speed).⁴

Resources are calculated in terms of peak bus hours because MBTA’s most restrictive constraints on vehicles and staffing occurs during the peak period. Peak period capacity determines the amount of service (both vehicles and staffing) that the MBTA can deploy at the same time. The resource calculation accounts for the number of buses per hour, whether a bus is completing inbound and outbound trips, the average speed of a bus, layover time for the bus operator to rest, and the peak period duration.

- **Corridor weights:** Because it is not possible to test and evaluate every combination of the 92,000 identified corridors as a network, the process focused on ensuring that the networks that were tested were likely to be good networks. To do this, each corridor was weighted so that corridors that were better at achieving system design objectives were more likely to be incorporated into the tested networks. Corridor weights were based primarily on the *demand** variable to emphasize equity and serving demand during this process. Corridors with a connection to a BAZ with a rapid transit station were given a 60 percent weight increase, in an effort to account for the additional demand that a route might serve with bus-to-rapid transit two-seat rides. This 60 percent weight increase corresponded to the amount of additional demand that could be served by connecting a bus route to a rapid transit line.

³ Note that this total resource level was later increased; refer to the “Deciding to Increase the Total Amount of Bus Service” header later in this section.

⁴ Later stages of route design used route-specific and time-of-day-specific speeds to better reflect actual local conditions.

- **Overlap among corridors:** While building networks, the overlap between corridors was calculated to avoid creating networks that inefficiently use resources by serving the same demand using multiple corridors. Once a corridor was included in a network, no corridors that served more than 66 percent of the same BAZs were allowed to be added to that network. This filter allowed for expansive networks while allowing certain core locations to be served by multiple corridors.

To evaluate the large number of potential networks sampled for each alternative, a scoring methodology was developed based on four types of trips served by the combined rapid transit and high-frequency bus network. The score for each network was defined by the following equation:

$$\text{score} = (1 * \text{bus one seat rides}) + (.67 * \text{bus to bus two seat rides}) + (.67 * \text{bus to rapid transit two seat rides}) + (.33 * \text{rapid transit to rapid transit two seat rides})$$

Where:

- bus one seat rides = *demand** trips that could be served with a one-seat ride on the sampled bus network
- bus to bus two seat rides = *demand** trips that could be served with a two-seat ride on the sampled bus network
- bus to rapid transit two seat rides = *demand** trips that could be served with a two-seat ride combining the sampled bus network and the existing Rapid Transit network
- rapid transit to rapid transit two seat rides = *demand** trips that could be served with a two-seat ride on the existing Rapid Transit network

Trips that could be served multiple ways (i.e., with both a bus one-seat ride and a bus to rapid transit two-seat ride) were credited to the higher category in this hierarchy. Weights for each of these trip categories were determined based on service design priorities. They were selected to give the highest importance to providing as many trips as possible with one-seat bus rides, followed by trips that are served by two-seat rides, including trips that feed the rapid transit network. Any trips that could be served by a one-seat rapid transit ride were not counted to limit bus service that was redundant with the rapid transit network. All networks were scored using *demand** from the serviceable connections dataset, which emphasized equity in scoring networks. The scoring process

outputs a spreadsheet, with each row representing one network with the score and the total demand in each of the trip types (and a not served category) as columns.

This process produced 100,000 possible networks, including 20,000 networks for the 80 percent alternative (sampled from 92,000 potential corridors). Once a single 80 percent network was selected, 40,000 networks were produced for the 40 percent resource alternative (sampled from the 40 potential corridors in the 80 percent network), and a single 40 percent network was selected. Finally, 40,000 networks were produced for the 60 percent alternative (sampled from the 40 potential corridors of the 80 percent network with the 20 corridors of the 40 percent network held constant). Sampling was structured in this way to ensure that each network was “nested” within each other.

THREE RESOURCE ALTERNATIVES

Three resource alternatives were defined for this process. Each alternative was a subset of the higher resource alternative (e.g., the 40 percent alternative was a subset of the 60 percent alternative). Doing this gave the project team a sense of which corridors to prioritize with lower resource levels, with the ability to identify and add additional corridors as more resources became available.

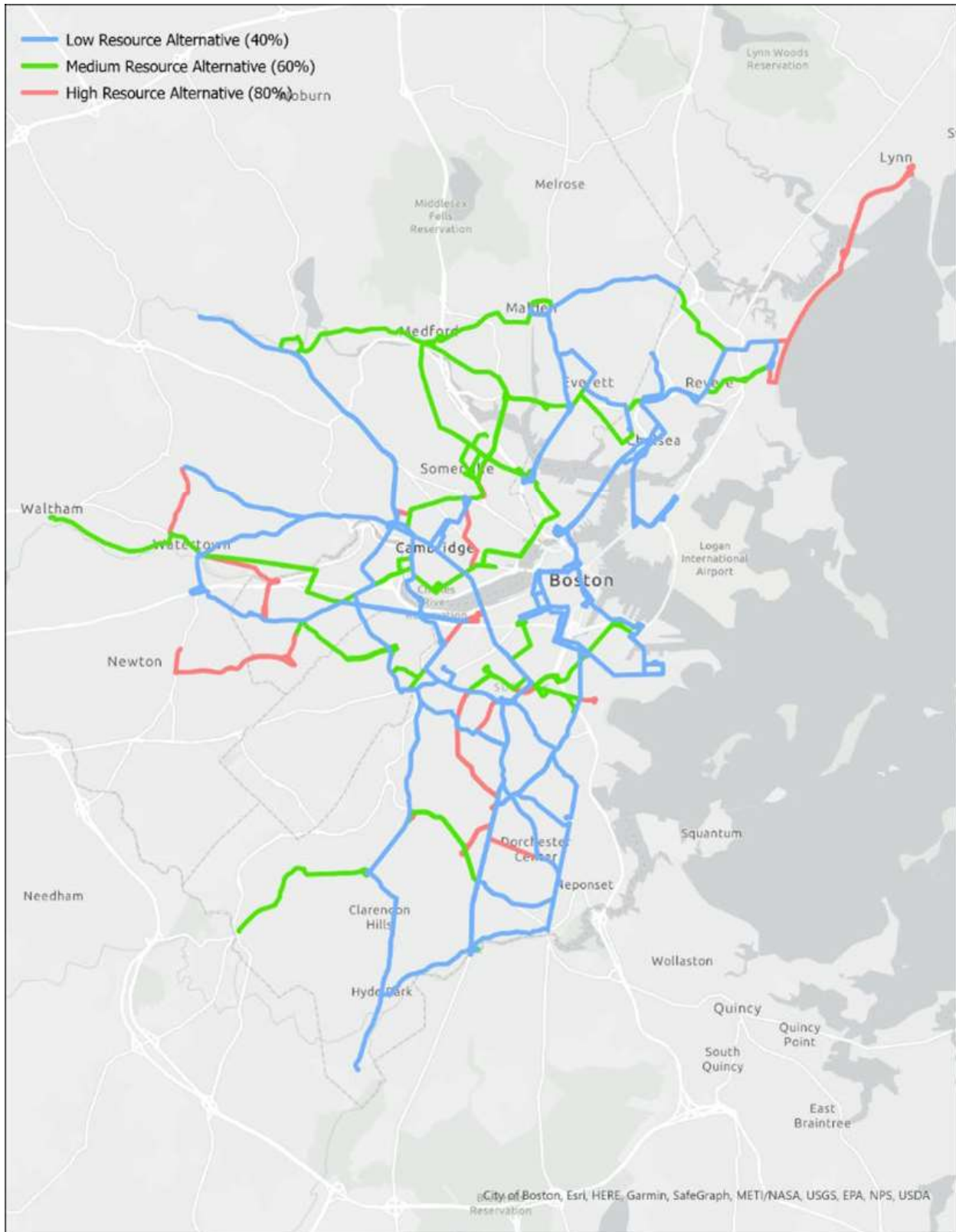
Based on the networks produced with this automated process, the project team selected the best of the networks to move forward into further planning. This decision was informed by quantitative scoring as well as more qualitative planning and scheduling guidance.

High Frequency Corridor Network Selection

To finalize the set of high-frequency corridors, the project team utilized a map that overlaid the 20 networks that received the highest score for the *demand** metric (reflecting travel demand for low-income and minority riders). The team reviewed this map to identify and combine both segments and entire corridors that consistently showed up in multiple networks and therefore represented important travel corridors for the network. Consideration was also given at this and subsequent stages to correcting for potential limitations of the LBS data, for example in serving the travel needs of seniors. Informing this was the results of the Travel Survey, which intentionally oversampled seniors among respondents, along with meetings and focus groups with seniors and community organizations.

This was an iterative process that involved combining different sets of corridors that aligned with important services, such as the existing Key Bus Routes, which the MBTA wanted to prioritize in order to maintain high-ridership routes that serve important travel corridors. Several of these Key Bus Routes were maintained across the corridor testing process. Corridor segments that connected to rapid transit stations or potential locations for bus layover and turnaround facilities were a focus area to combine into final corridors. Adjustments were made to balance out demand, including extending the terminals of existing routes to operate as crosstown services and to reach logical terminals, or “swapping” terminals between existing routes to adjust route travel times while maintaining access for connections with high demand. The project team then tested the combinations against the total *demand** scores to see how they compared to each other. The resulting selected networks for each alternative is shown in Figure 5.

Figure 5 Map of High-Frequency Networks for Each Resource Alternative Following Automated Network Generation Process



Turning High-Frequency Corridors into Routes

The network at this point was still not made up of routes that would be suitable for actual operations: it consisted of corridors that had been assigned to roadways by an automated process that relied on a shortest path algorithm. To turn these into actual routes, additional work was needed to design routes that considered important factors such as:

- Transfer points between bus routes and to rapid transit stations
- Streets that were most suitable or logical for a bus route
- Major attractions and destinations, such as schools, medical facilities, commercial areas, and other important locations
- Difficult or infeasible turning movements
- Good layover locations, including factors such as space for bus parking, bus operator break facilities, turnaround options, etc.
- Examining potential variants, cycle times, and testing frequencies

The process was completed through a series of team workshops focused on specific geographies to gather expertise on specific locations. It focused on converting the initial corridors to routes across three resource alternatives (40 percent, 60 percent, 80 percent networks). This route refinement process happened through a series of collaborative workshops with the MBTA Service Planning team in May and June 2021, resulting in feasible, realistic high-frequency networks for each of the three resource alternatives.

Designing the Rest of the Network

With the high-frequency routes now defined for each resource alternative, the non-high-frequency routes were designed. This process used a combination of tools to understand and design for travel demand, while incorporating an understanding of the local context through multiple workshops with service planning teams.

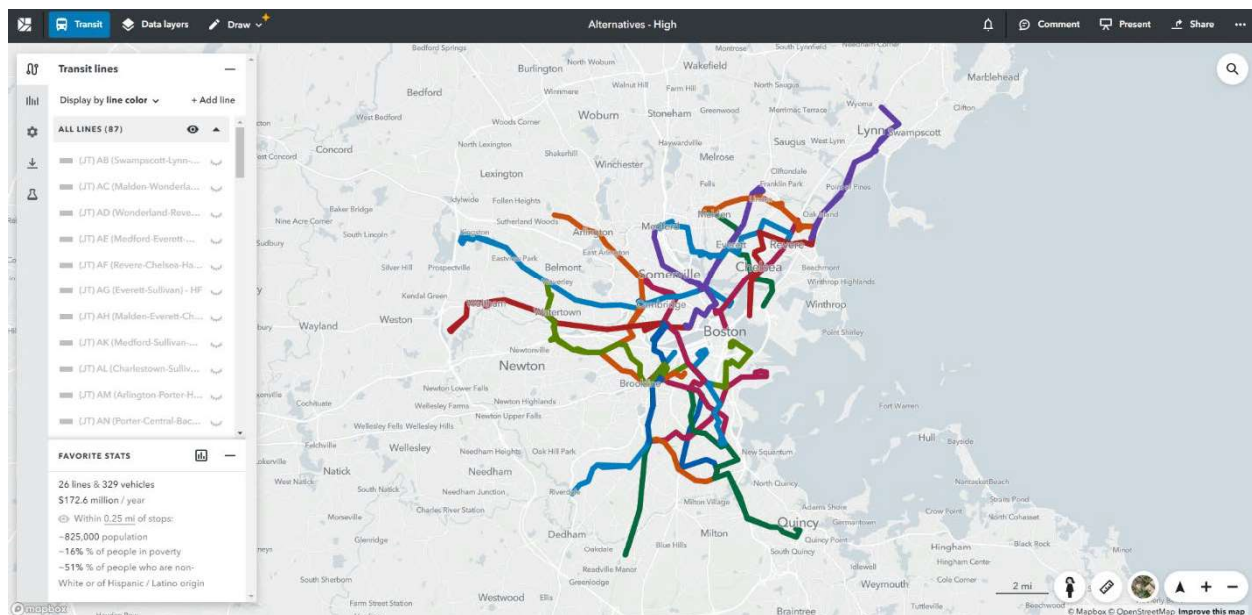
Through this process, the project team examined existing routes to understand environmental or operational parameters that affect today's routing and future routing. The project team incorporated feedback from service planners and bus operators, which provided detailed knowledge of local road and layover conditions and local trip generators.

Inputs and Tools

Remix

The project team used Remix to visualize routes and networks. Remix is an online tool, available to transit agencies, which allows a user to create or modify transit routes and have certain additional factors (such as running time) automatically calculated based on inputs. Remix was used for service design processes and to share outputs both within MassDOT and the MBTA, and externally. Individuals also used Remix to record their comments on routes during stakeholder engagement and public outreach activities.

Figure 6 Screenshot of the Remix Service Design Tool



Within Remix, the team incorporated a number of different pieces of existing information in order to provide context to the service planners designing a specific route. The data gave additional context to the spatial information. Data included within the Remix tool during the design process included:

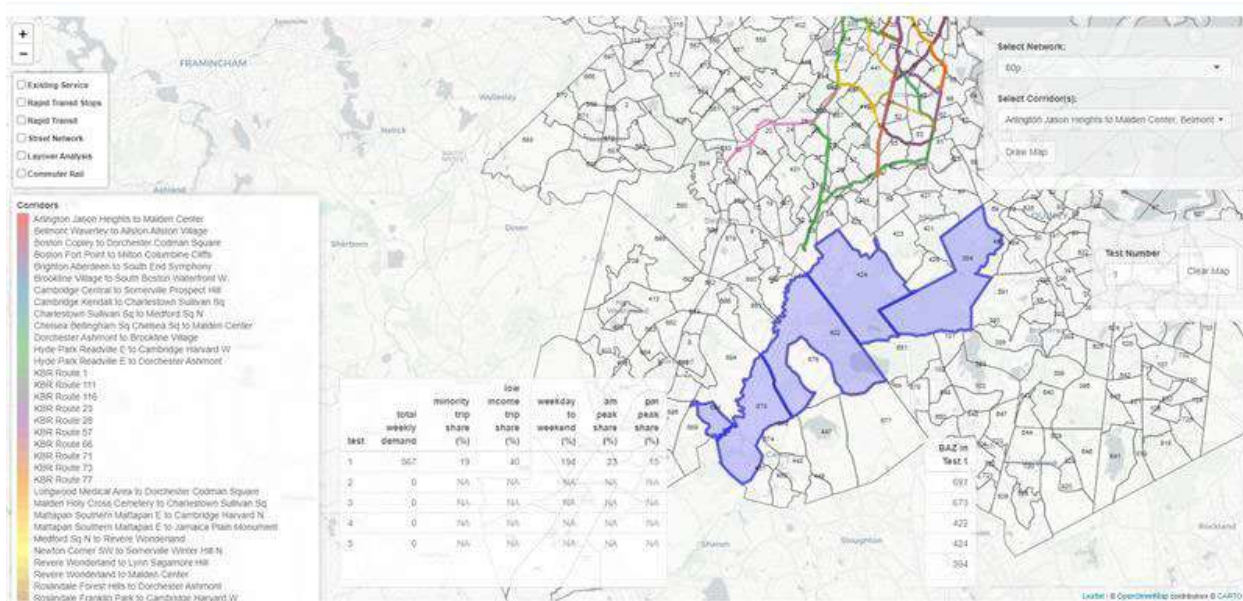
- The MBTA's existing bus routes and other transit routes
- BAZs
- Origin-destination data from the LBS data imported into the platform
- Bus resource hours per route and network used for planning around alternatives

- Walk isochrone tool (“Jane”), used to ensure walkability to a bus route from specific destinations (schools, elder care centers, etc.)⁵
- Census data (poverty level, education level, etc.)

BAZ Selection Tool

The BAZ Selection Tool allowed the user to pick a series of BAZs and determine the total quantity of demand occurring between the selected zones. The tool allowed testing custom corridors by selecting a series of BAZs, displaying the total trips, minority trips, and low-income trips between them. As a series of BAZs were selected, the tool referenced an O-D table and aggregated trips from all possible O-D combinations met within the series. A table was generated displaying the aggregated results between the BAZ series. Multiple BAZ series could be selected and compared.

Figure 7 Screenshot of the BAZ Selection Tool



Network Coverage Tool

The Network Coverage Tool helped ensure that any proposed network changes maintained coverage for locations that currently have bus service by identifying locations that were more than a quarter-mile distance from proposed bus service. This tool produced a map which visualized the distance between the current and proposed

⁵ “Jane” refers to an isochrone that visualizes access and mobility across a transit network for Jane, who can be dragged and dropped to a location from which the isochrone is generated. More information can be found here: <https://www.remix.com/blog/improvements-to-jane-new-travel-limits-reverse-jane>.

networks to ensure that service coverage was maintained to the degree possible. Service planners used the tool to fill in gaps in the network to meet current coverage while looking for new opportunities for route efficiency and service.

Figure 8 Screenshot of the Network Coverage Tool



Lower-Frequency Network Design Process

The non-high frequency network design process culminated in one final network that was submitted to MBTA Service Planning for a series of additional workshops, edits, and reviews before going to the public for feedback. At this stage, the high frequency service in the networks was considered “locked” and focus was shifted to designing the non-high frequency routes to provide coverage to the remainder of the MBTA service area. This order was followed to ensure connectivity within the full network.

Effectively allocating resources between the high frequency and low frequency service was a key element of the process, ensuring that any proposed services could be operated using the same level of resources currently operated by the MBTA. The team used a resource calculator that allowed the team to understand the resource requirements for different types of services and make changes to routes accordingly. All route-level resources were calculated using bus hours, and route benefits were evaluated in terms of demand and ridership data as well as accessibility considerations.

The non-high frequency network design stage “filled in the gaps” between and around the high-frequency network. These routes were geared towards coverage, providing service

outside of the developed high-frequency alternative to ensure access to service was preserved in most of the current MBTA service area. Service frequency decisions, assigning routes to the categories of medium, low, and peak-only service, were guided by the demand data. This analysis also included consideration for express routes or neighborhood routes and utilized the same workflow as in the low and high frequency workshops.

Table 3 Frequency Assumptions by Time of Day for Resource Use Calculations

Day	From	To	High Frequency	Med Frequency	Low Frequency	Peak Only Frequency
Weekday	5:00	6:00	15	45 (or NA)	NA	NA
	6:00	9:00	8	22	45	30 (one way)
	9:00	16:00	11	22	45	NA
	16:00	19:00	8	22	45	30 (one way)
	19:00	22:00	11	30	90 (or NA)	NA
	22:00	1:00	15	45 (or NA)	NA	NA
Saturday and Sunday	5:00	6:00	15	45 (or NA)	NA	NA
	6:00	19:00	11	22	45	NA
	19:00	22:00	11	30	90 (or NA)	NA
	22:00	1:00	15	45 (or NA)	NA	NA

Finalizing the Lower-Frequency Routes

Following an initial draft design for the non-high frequency routes in each part of the service area, a series of workshops in September 2021 were held with the MBTA Service Planning team to solicit comments and feedback. This iterative, looping process allowed for direct and clear feedback to the design team. Feedback was also taken through online tools, allowing staff to geocode comments for ease of use. Tradeoffs were evaluated based on the service design principles discussed in Section 2.

These workshops resulted in decisions about the final set of routes with defined frequency levels for the new network.

Refinements to Finalize Specific Routings

Following the September workshops, the draft map was largely complete: all major decisions about routing and frequency had been made. However, there were many small

refinements that were still required to finalize the draft map for public comment. Gathered from October 2021 through January 2022, these refinements included:

- **Refining detailed routing of each route.** This included ensuring that routes were mapped as serving the terminals they were intended to, that appropriate transfer points were created, and important connections along a route were served.
- **Associating bus stops with routes in Remix.** The route design process was focused on drawing route lines and not locating specific stops. Much of the work in this stage was making sure that existing bus stops were appropriately captured.
- **Incorporating bus operator and Operations Department feedback.** During this process, many of the new routings were tested for operational feasibility. A tool was created to identify where proposed routes would operate on new streets or make turns in new locations. These locations were investigated to determine if the streets were wide enough for bus travel, that turns were feasible, that grades were acceptable, and other potential operational issues identified. This included meeting with the MBTA Training School on multiple occasions to review the proposed routes and sending a test bus out to complete feasibility tests in many areas. It also included reviewing route terminals for turnaround feasibility, operator comfort and restroom access, and other related concerns.
- **Bookkeeping and accounting refinements.** Routes were checked for consistent frequencies and span-of-service within frequency categories, and resource calculations were refined for the new network.

Deciding to Increase the Total Amount of Bus Service

During preliminary internal reviews of the three resource alternatives (40 percent, 60 percent, and 80 percent alternatives), the project team concluded that the high-frequency network in the 60 percent alternative was the most desirable and successful in meeting the overall goals of BNRD. It would significantly and equitably expand access to high-frequency routes across the region, provide significantly improved service to non-downtown centers, and represent a transformative change.

25% INCREASE IN BUS SERVICE

To increase the amount of high-frequency service and maintain the desired medium- and low-frequency service, BNRD includes 25% more bus service than pre-COVID levels.

However, with a constraint on total available resources, allocating 60 percent to high-frequency service would necessitate a significant decrease in other bus service throughout the network. This change would result in either reductions in service levels in many areas further than was deemed acceptable, or a smaller service area than exists today.

The project team was concerned about the impacts of these constraints on the network's ability to achieve the BNRD goals of increasing access to all-day high-frequency service while providing increased off-peak and weekend service on lower frequency service across the service area. The project team estimated that a 25 percent increase in resources would provide sufficient operating capacity to achieve the desired increases in high-frequency service while allowing the MBTA to achieve its goals of increased service on off-peak hours and weekends. The 25 percent resource increase was internally approved by the Secretary and General Manager in fall 2021, and was subsequently solidified through the following spring release of the initial draft map.

The Draft BNRD Network: May 2022

The draft BNRD network was published for public comment in May 2022, with an extensive campaign to solicit and gather feedback from riders, municipal partners, elected officials, and other stakeholders on the proposed changes. A map of the frequent service in the draft BNRD map is shown in Figure 9, and a map of service by headway in the draft BNRD map is shown in Figure 10.

Figure 9 Draft BNRD High-Frequency Network, May 2022

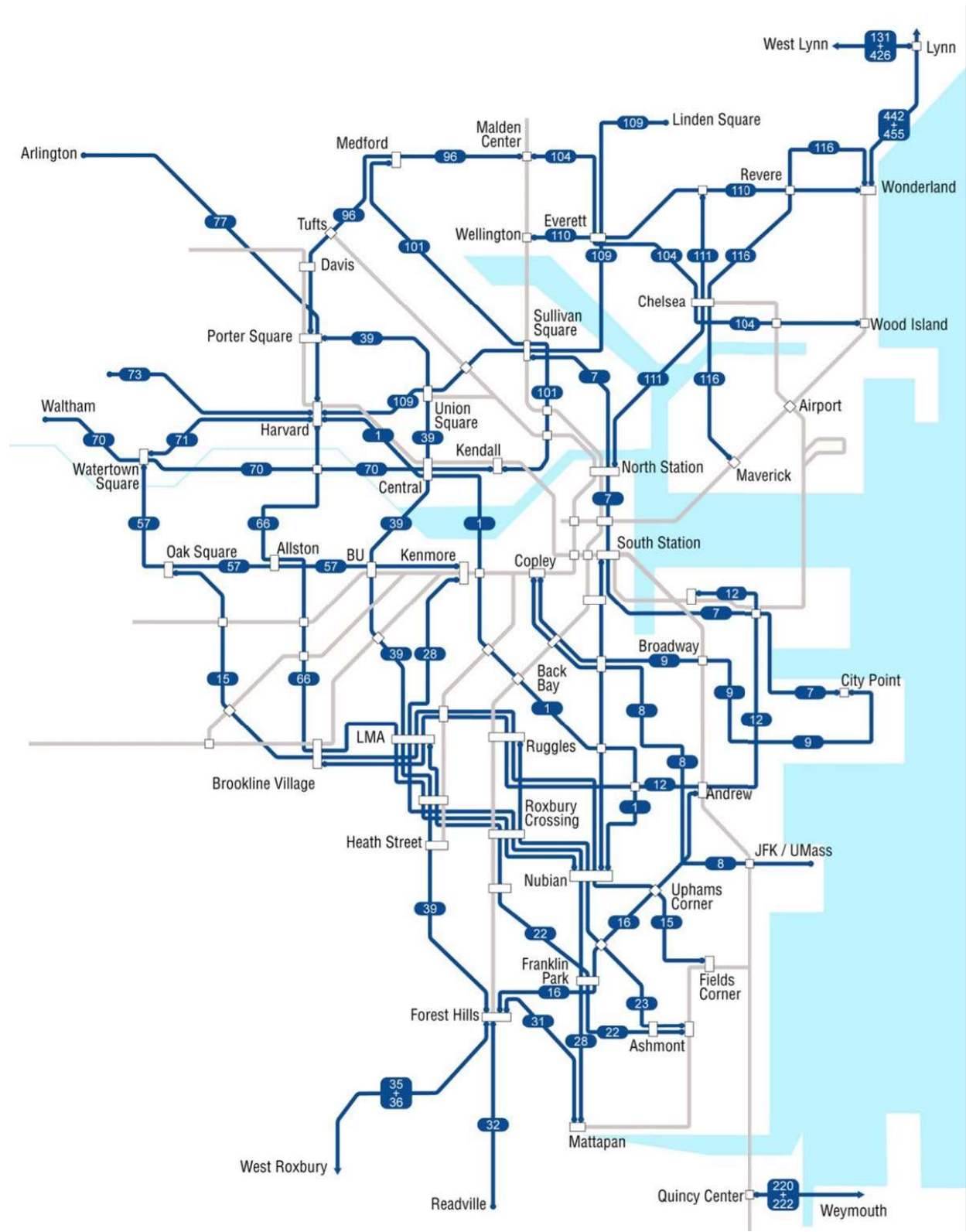
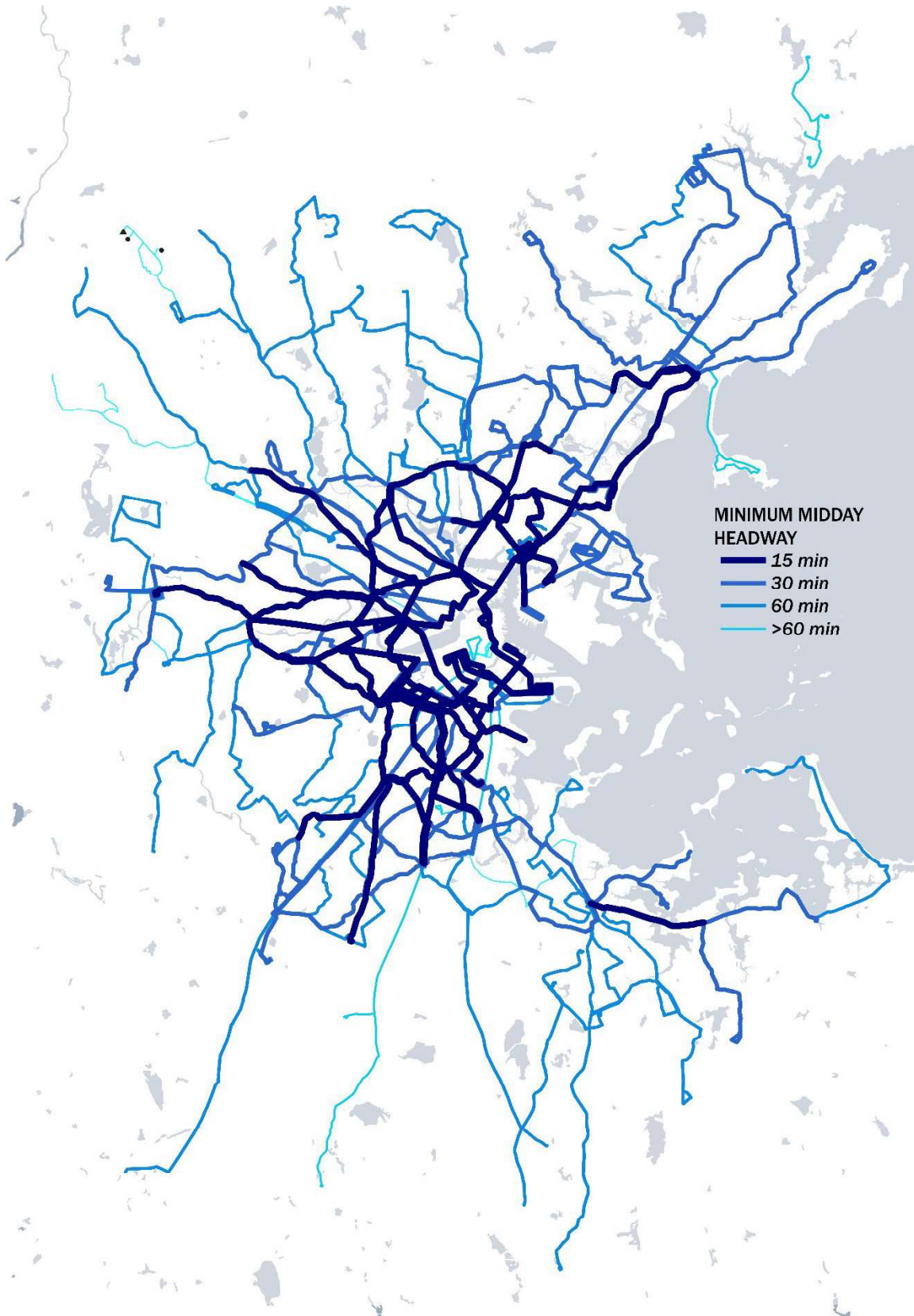


Figure 10 Draft BNRD Network, May 2022



The draft network achieved many of the goals that BNRD was trying to accomplish. The key messages the project team brought to the public related to the draft network of May 2022 included:

- **Providing better service for low-income populations and communities of color.** In the draft network, significantly more residents of color and low-income households would have access to high-frequency service.
- **Doubling the amount of high-frequency service.** The draft network would give many more residents access to 15-minute or less, all-day, 7-day-a-week service; bring the number of high-frequency routes from 15 to 30, make 50 percent of weekday service frequent; and add high-frequency routes to several key non-downtown locations.
- **Provide more midday, evening, and weekend service.** The draft network would add significantly more service, particularly on weekends.
- **Create better connections to more places.** The draft network would better reflect travel demand, much of which is local and cross-town rather than to downtown. It would also improve access to the top regional destinations (such as Longwood Medical Area, South Boston Waterfront, Back Bay, and Kendall Square) with fast, frequent service.
- **Making service simpler and easier to understand.** The draft network would have more routes that run the same service all day, every day. Fewer exceptions, variations, and complication.

The public feedback process identified significant changes that needed to be made to the design of the network. The various efforts to collect public feedback and the results of the public feedback process are described in Section 4, and the changes made to incorporate that feedback and get to the final network are described in Section 5.

4

A Public Outreach Success Story

Public outreach was a core part of the network redesign, starting well before the BNRD process began, and directly informing each step of the way. This section documents that public outreach success story.

Better Bus Project Initial Outreach

The Better Bus Project was created as part of the MBTA's \$9.6 billion, five-year capital investment plan in 2018 to improve bus service throughout the MBTA service area. In 2018, the Better Bus Project team met with communities to help define the current state of the bus system, understand where it was working well, and where the MBTA needed to improve. The team held regional public meetings, briefings, listening sessions with bus operators, and collected feedback from bus riders through conversations at bus stops and stations as well as through an online feedback form. More than 3,000 riders shared feedback about their experiences, including a desire for more frequent, more reliable service throughout the day, not just during peak service hours. Conversations with planners, operators, and technical analysis confirmed that there are too many route variations and deviations and too few routes with frequent, all-day service. Initial changes were implemented in 2019 to provide more frequent, consistent, and reliable service, as well as a small number of new connections. More information about the outreach conducted during the 2018-2019 Better Bus Project outreach period is available in the Near Term Changes Report.⁶

⁶ May 2019 Near-Term Changes Report.
<https://cdn.mbta.com/sites/default/files/projects/betterbus/documents/2019-05-betterbus-near-term-changes-report-accessible.pdf>.

The experience and information gained by agency staff during the initial Better Bus Project outreach shaped a series of initiatives over the subsequent five years, including Bus Network Redesign (BNRD). The Bus Network Redesign project was designed to build on the groundwork of outreach and engagement established in the Better Bus Project. BNRD carried forward its principles of meeting current and prospective riders where they were—including engaging people at stations when they were waiting for MBTA bus services, so that the MBTA could hear what they thought when taking the bus was at the forefront of their minds. Similarly, the BNRD initiative followed the Better Bus Project’s multi-pronged and proactive engagement strategy, with the project team facilitating a wide array of open houses with the general public and briefings with community organizations and public and elected officials.

Public Outreach Tools

The project team utilized several tools to engage with the public around Bus Network Redesign, including, but not limited to:

- Project webpages and social media:
 - The MBTA continued to keep the Better Bus Project (mbta.com/betterbus) and Bus Network Redesign webpage (mbta.com/bnrd) updated with information about the project and events, including additional sub-pages to host the detailed information and materials shared during the outreach periods.
 - The MBTA also utilized various social media platforms to provide notice and advertising about the outreach.
- The project inbox, BetterBusProject@MBTA.com:
 - The project team managed the BetterBus@MBTA.com inbox and received and responded to submitted comments, questions, and suggestions from the public throughout the project.
- The GovDelivery email delivery platform:
 - The MBTA utilized the GovDelivery email delivery platform to send out notifications on events and to provide updates on the project to subscribers.
- Meetings and briefings with key stakeholders, including elected officials, advisory organizations, and community groups.

- Signage and print materials in nine number of languages.
- Promotional videos and station ads.

More details about these and other outreach tools used are included at the end of this chapter.

Outreach Leading to Draft Network Map (Summer 2019–Winter 2022)

The MBTA conducted a variety of outreach and engagement activities with stakeholders throughout the Greater Boston area to identify challenges, needs, and priorities related to bus service and transit access. These activities helped to inform the development of the Draft Network Map.

Demonstration Project Submissions

In July 2019, the MBTA encouraged stakeholders to submit ideas for new service concepts that would inform the design of different bus network alternatives with ideas ranging from smaller scale changes on existing service to more significant interventions that would require infrastructure changes.

Travel Survey

The project team collected additional data about important regional destinations through the Bus Network Redesign Travel Survey from June 14 to August 18, 2021. In this survey, the MBTA encouraged riders and other stakeholders to provide input on if the MBTA takes them where they need or want to go and if riding the MBTA is a good option for travel. The survey had two versions: a map-based interactive ArcGIS-built version and an accessible text-based Qualtrics version.

Among other questions, the survey asked participants to consider which types of places in the Greater Boston area were important for all residents of the region to be able to access. All participants were given a list of roughly 22 destinations, independent of home location (provided with checkboxes to confirm places with which they agreed and a text box to submit places they felt were missing). Participants taking the survey over the phone received a random list of approximately one third of the destinations to accommodate time constraints. Both survey versions collected demographic information encompassing age, race and ethnicity, gender, income, and self-identified disability.

Both versions of the survey were available on the MBTA website, and engagement events, such as public meetings and street teams, promoted the survey to participants. Seniors were oversampled through events in partnership with the Massachusetts Senior Action Council (MSAC), in which MSAC and MBTA staff often led participants through the survey, over the phone or in person, and recorded their responses. In total, the survey received about 1,700 responses, which were weighted based on the respondent's residential area.

Events & Meetings

Outreach for open houses and public meetings typically included flyers and print ads in local newspapers, such as the Bay State Banner, Brazilian Times, El Mundo, and Sampan, as well as email blasts. All virtual events included captioning in English and Spanish interpreters. Virtual events were recorded and posted on the project website.

Better Bus Project Open House Featuring Bus Network Redesign, March 2020

The MBTA planned a Better Bus Project Open House for March 10, 2020 to share information about initiatives to improve bus service across the system. The Open House would feature a presentation on Bus Network Redesign to introduce the project. Due to public health concerns regarding COVID-19, the MBTA canceled the Open House. Project materials, including boards, were posted to the website in lieu of the meeting.

Bus Network Redesign Public Meeting (Virtual), June 2021

The MBTA hosted its first Bus Network Redesign virtual public meeting on June 8, 2021. The meeting provided an overview of the Bus Network Redesign, and project staff were available to take feedback and answer questions. There were 218 attendees, including five phone-in attendees.

Better Bus Project Open House (Virtual), August 2021

On August 26, 2021, the MBTA hosted a Better Bus Project virtual Open House to share information about initiatives to improve the bus experience. Presentations were given by project teams across the MBTA, including:

- Bus Transit Priority
- Bus Stop Accessibility Improvements
- Bus Network Redesign

- Bus Operations
- Silver Line Extension
- Bus Electrification and Facility Modernization
- Bus Stop E-Ink Signs

Bus Network Redesign Public Meeting (Virtual), October 2021

The MBTA hosted a virtual public meeting on October 27, 2021. This meeting presented the Bus Network Redesign approach and principles that the MBTA and MassDOT were using to propose a transformation of the region's bus system. The project team was also available to take feedback and answer questions. There were 154 attendees, including five phone-in attendees. This meeting was also livestreamed by Boston Neighborhood Network Media (BNN) on the News & Info Channel (Xfinity 9 | RCN 15 | Fios 2161).

Briefings & Meetings

The MBTA provided a variety of briefings to community groups, legislators, municipalities, and state agencies to share information and promote community and interagency collaboration. Between June 2021 and February 2022, the MBTA met with these organizations to discuss BNRD goals and objectives and to review preliminary High-Frequency corridors identified through the travel demand analysis process.

The project team met with representatives from over 20 municipalities, discussing the topics of transit priority, expanded layover locations, new bus shelters and more accessible bus stops. The MBTA targeted these conversations to reach the municipalities with the highest bus ridership and those that would experience the most significant changes with the proposed BNRD map. The MBTA also held conversations with officials in response to specific questions, concerns, or feedback that was directly received during BNRD outreach.

These meetings occurred in a variety of formats including attending local City Council hearings, speaking with Select Boards, and meeting with advisory boards. MBTA project team members attended these briefings upon request from these bodies. In these meetings, the project team consulted with elected officials about the service plan and provided an overview of the routes and the project methodology. The MBTA held more than 40 briefings and meetings between June 2021 and February 2022 with the following 25 municipal and state agencies:

- Boston Transportation Department
- Boston Planning and Development Authority
- Boston Mayor's Office
- Boston City Council
- City of Arlington
- City of Cambridge (City staff and Transit Advisory Committee)
- City of Chelsea
- City of Everett
- City of Lynn
- City of Malden
- City of Medford
- City of Newton
- City of Quincy
- City of Revere
- City of Somerville
- City of Waltham (City staff and Traffic Commission)
- City of Watertown
- Massachusetts Department of Conservation and Recreation
- Massachusetts Department of Transportation
- Massachusetts Port Authority
- Metropolitan Area Planning Council
- Town of Belmont (Town staff and Transportation Advisory Committee)
- Town of Brookline (Shared Mobility Advisory Committee)
- Town of Lexington
- Town of Stoneham (Town staff and Transportation Advisory Committee)
- Town of Winthrop

Additionally, the MBTA briefed elected officials in the Massachusetts State Legislature on BNRD before the final rollout of the map and maintained an open dialogue with elected officials throughout the process. The MBTA held more than 10 meetings and briefings between June 2021 and February 2022 with the following State legislative organizations and local officials:

- Boston Region MPO—Metro Mayors' Coalition
- Massachusetts State Legislature—Boston Delegation Representatives
- Massachusetts State Legislature—MBTA Caucus Representatives
- Massachusetts State Legislature—Transportation Committee Chairs

During this time period, the MBTA also met with representatives from several community and advocacy organizations. Oftentimes, these meetings took the form of hosted focus groups, either in-person or virtual. During these focus groups, MBTA staff asked region-specific questions (for example, the varied topography of Admirals Hill) to receive more targeted feedback on the routes. These sessions were then followed by an open Question and Answer session with the attendees. The project team hosted focus groups in English, Spanish and Chinese. The MBTA held meetings or focus groups with the following organizations:

- Allston Brighton Health Collaborative
- Asian American Service Association
- Boston Center for Independent Living
- Boston Disability Commission
- The Brazilian Worker Center
- Chinatown Coalition
- Chinese Golden Age Center
- GreenRoots (meetings facilitated in English and Spanish)
- La Comunidad (meetings facilitated Spanish)
- Livable Streets Alliance
- The Longwood Collective (formerly the Medical Academic and Scientific Community Organization)
- Massachusetts Senior Action Council
- Transit Matters
- T Riders' Union
- Riders' Transportation Access Group
- Quincy Asian Resources, Inc.
- Quincy Community Action Partners
- Quincy Head Start
- Union Capital Boston (meetings facilitated in English and in Spanish)
- Wollaston Senior Center

The MBTA also participated in public events, including farmer's markets and art festivals, in order to raise public awareness of BNRD at high-traffic, interactive community spaces.

Email Blasts (E-Blasts)

The project team sent project updates, meeting announcements, and reminder emails to numerous riders, community organizations, and other stakeholders. The list below only

includes BNRD-related communications, as this account was also used for other bus initiatives, and does not include reminder emails.

- Sent **9 e-blasts** to promote Bus Network Redesign demonstration projects, Better Bus Project open house notices, and BNRD updates, survey, and events: average open rate of 35 percent and average click rate of 7 percent
- **2,821** email subscribers in first BNRD email blast (July 29, 2019)
- **3,570** email subscribers in final email blast prior to Draft Network Map outreach (November 4, 2021)

Table 4 Email Blasts, July 2019–November 2021

Date Sent	Subject Line	Number of Recipients	Open Rate	Click Rate
07/29/2019	Bus Network Redesign Soliciting Ideas for Demonstration Projects	2,821	42%	10%
02/14/2020	Learn About Exciting MBTA Bus Initiatives at Our Open House on March 10	2,986	39%	5%
03/10/2020	Open House Canceled ¹	2,975	35%	N/A
05/11/2021	Bus Network Redesign Update and Public Meeting on June 8	3,454	36%	8%
06/14/2021	Bus Network Redesign Survey Launched, Meeting Materials Available	3,403	33%	9%
07/27/2021	Bus Network Redesign Survey Extended to August 8 th	3,656	33%	6%
08/19/2021	Virtual Open House on August 26	3,636	33%	8%
10/01/2021	Bus Network Redesign Public Meeting #2 on October 27	3,614	34%	5%
11/04/2021	Bus Network Redesign Meeting Materials Available	3,570	33%	5%

¹ The March 10, 2020 Open House was canceled due to COVID-19.

Spring/Summer 2022—Draft Network Map Outreach

In May 2022, the MBTA unveiled a draft service proposal—a map of a new proposed bus network, with estimates of frequency and span (the hours the bus service would operate) called the Draft Network Map. The release of the Draft Network Map was followed by an 11-week public engagement period, during which the MBTA held or attended more than 112 events, including virtual and in-person meetings, open houses, street teams, and briefings. It was essential for the MBTA to share the Draft Network Map widely to both educate riders and stakeholders of the map’s potential benefits and impacts and collect feedback on how the map could be improved. The MBTA also wanted to assess whether riders and stakeholders thought the routes went where they needed them to go and if the routes would be competitive with other travel options. The MBTA also wanted to learn if there are any impacts or considerations that staff were not aware of.

During the public engagement period, project team members had over 9,000 interactions with riders and collected over 20,000 comments on the Draft Network Map.⁷

Purpose of Draft Network Map

Through analysis of rider feedback, location-based data, and an understanding of what makes bus service competitive, the project team developed a preliminary new network map that provided a simpler and easier-to-understand network with more high-frequency corridors, better connections to major regional and local destinations, and a focus on all-day service. Section 3 of this report provides an overview of how MassDOT and the MBTA developed the Draft Network Map using travel demand data for different sociodemographic groups to build corridors and refine them into networks with a combination of inputs from planning staff and bus operators.

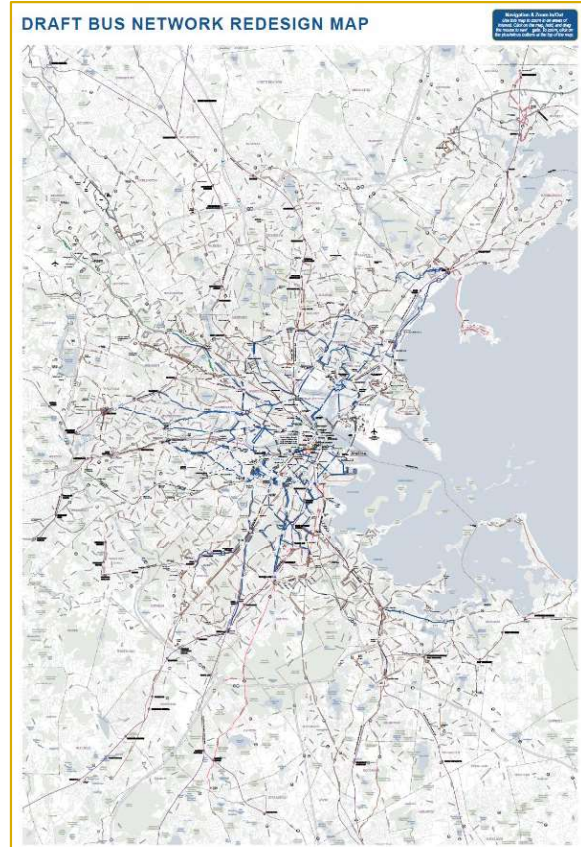
Input from riders, elected and public officials, and community groups, as well as bus operators, was essential to ensure that the new network would meet the public’s needs and priorities while being operationally sound and navigable along the streets of the Greater Boston area. Distributing, promoting, and discussing the network map with stakeholders allowed the MBTA to make sure the network would reflect these changing travel needs and position the agency for a successful and meaningful implementation.

⁷ Number of interactions include attendees who signed in at community meetings, open houses, briefings, and hearings, plus distributions of materials to riders at open houses and street teams.

Draft Network Map

The Draft Network Map was made available in the following formats:

- **Comparison maps**—one regional map showing existing bus service and one regional map showing the proposed bus service
- **Diagrammatic/schematic high-frequency route map**—showing the high frequency corridors
- **Neighborhood maps in fact sheet booklets**—35 booklets displaying proposed service in different neighborhoods in the bus service area (see below for additional details)
- **Remix map**—Interactive map posted on the project website that allowed users to click through the updated routes to view weekday and weekend service hours and frequencies as well as the locations of stops along each route.
- **Trip planning tool**—A tool posted on the project website that allowed users to make a direct comparison between their current trip and the Draft Network Map, to compare itineraries.



Other Materials

Neighborhood Fact Sheets

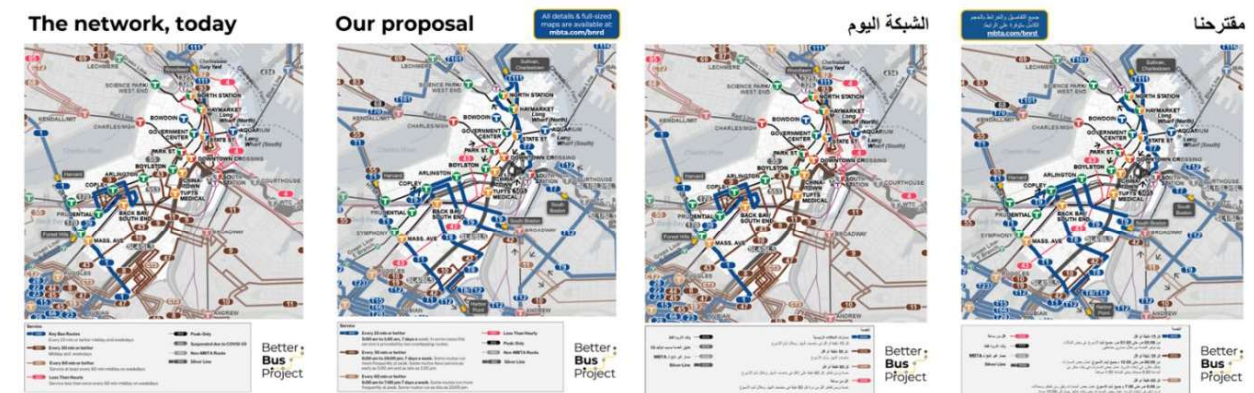
The MBTA created Neighborhood Fact Sheets, which were 11"x17" folded booklets with descriptive inserts, for 35 neighborhoods throughout the bus network. Each Neighborhood Fact Sheet provided detailed information and maps about the specific changes to routes in that neighborhood compared to the existing routes as well as a quantitative summary of what the changes mean for riders. These fact sheets were posted on the website and distributed at open houses, the in-person hearing, and meetings and

briefings with riders and other stakeholders. These documents were available in nine languages: English, Spanish, Arabic, Chinese (Simplified), Chinese (Traditional), French, Haitian Creole, Portuguese, and Vietnamese.

Figure 11 BNRD Neighborhood Booklet Example from 2022 Outreach Booklet in English and Arabic (Cover)



Figure 12 BNRD Neighborhood Booklet Example from 2022 Outreach Booklet in English and Arabic (Inside)



Network Change Booklet

The MBTA produced Network Change Booklets, which were 8.5"x11" folded booklets available in nine languages (English, Spanish, Arabic, Chinese (Simplified), Chinese (Traditional), French, Haitian Creole, Portuguese, and Vietnamese), to provide a brief overview of Bus Network Redesign and share details about in-person and virtual community meetings, hearings, and open houses. These booklets were posted on the website and distributed at open houses, street teams, and meetings and briefings with riders and other stakeholders.

Figure 13 BNRD Network Change Booklet from 2022 Outreach Booklet in English and Arabic (Cover)



Figure 14 BNRD Network Change Booklet from 2022 Outreach Booklet in English and Arabic (Inside Text)



Bus Network Redesign Online Content & Website

The updated website was launched in May and included a description of the project, the project timeline, information about how to get involved and to sign up for email updates, downloads of public meeting documents, and lists of upcoming and past meetings. To house the proposed Draft Network Map and Neighborhood Fact Sheets, the MBTA developed a separate webpage: mbta.com/bnrdneighborhoods. Also included on this webpage was an [interactive map](#) on the Remix platform, where visitors could zoom in and out, pan around, and select specific routes for detailed information at the street level, and information on how to provide feedback.

Table 5 Website Pageview Statistics

Webpage	Number of Pageviews (May 16–July 31)	Average Time on Page (Seconds)
mbta.com/bnrd	34,718	139.08
mbta.com/bnrdneighborhoods (proposal page)	93,318	71.93

Figure 15 BNRD Webpage—Pageviews During Comment Period

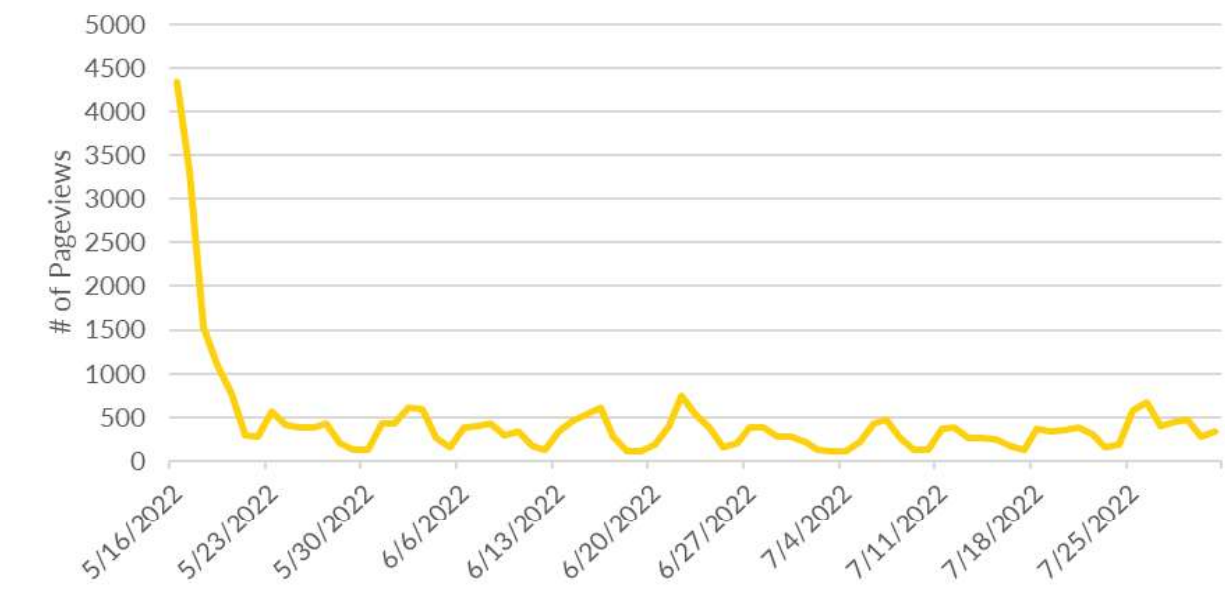


Figure 16 BNRD Webpage—Pageviews During Comment Period (After Launch Week)

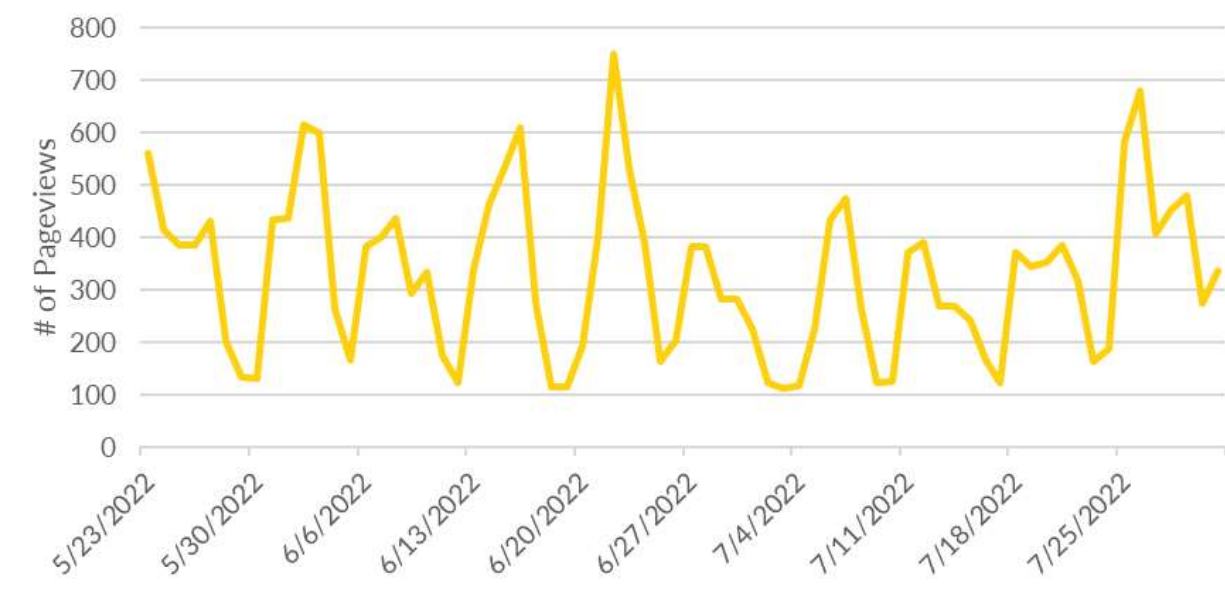


Figure 17 BNRD Proposal Webpage—Pageviews During Comment Period

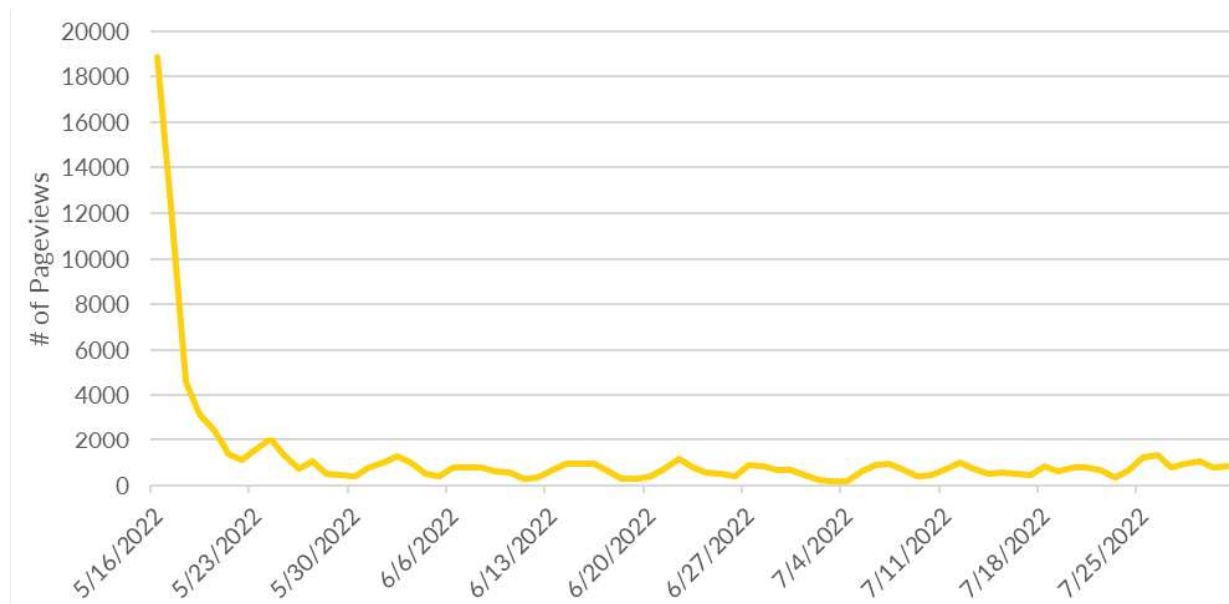
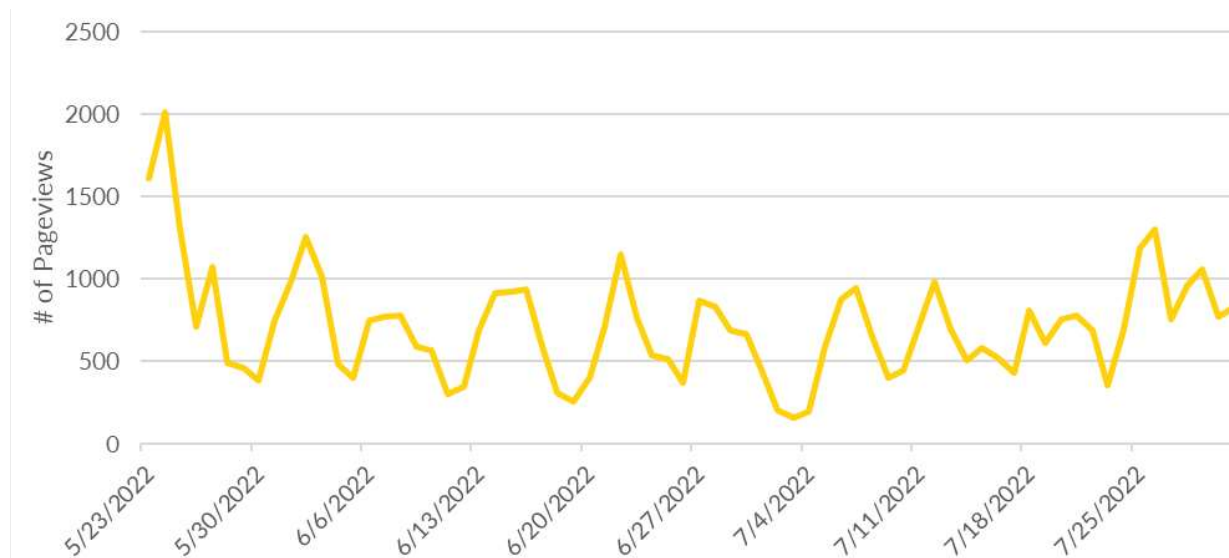


Figure 18 BNRD Proposal Webpage—Pageviews During Comment Period (After Launch Week)



MBTA Customer Experience also developed a [video promoting Bus Network Redesign](#) which was posted on the project page May 16, 2022. The video was available with English and Spanish subtitles and, as of November 17, 2022, had **3,358 views**.

Figure 19 Screenshot of Bus Network Redesign Webpage

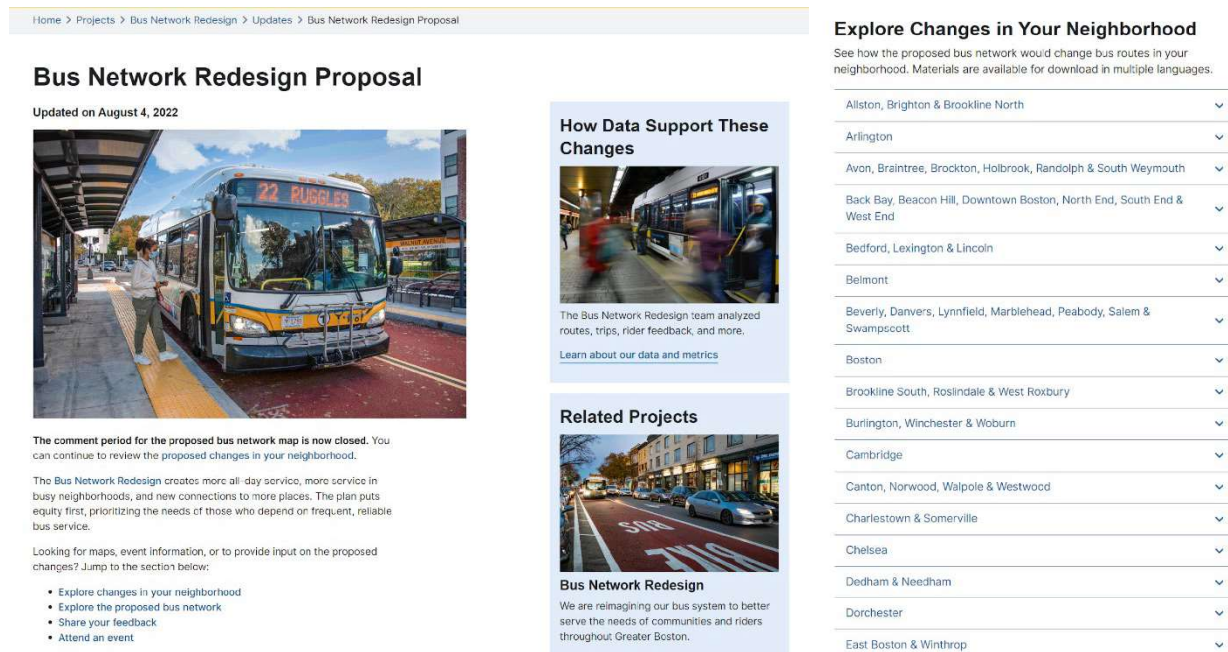
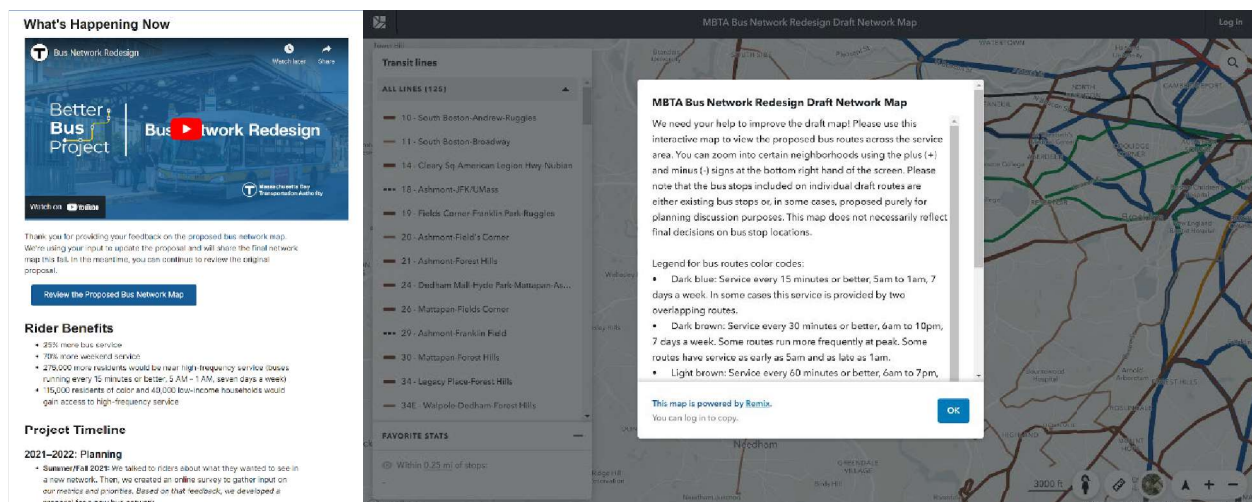


Figure 20 The Bus Network Redesign Webpage and the Interactive Map on the Remix Platform



Opportunities for Feedback

The MBTA reviewed all feedback received on the project in order to develop a Revised Network Map. In addition to accepting general comments via email letters, individuals could complete forms online and in-person, and speak with project team staff at in-person events, about the Draft Network Map. Table 6 provides information on the types of feedback collected by the project team and how many comments each type of feedback received.

Table 6 **Types of Feedback Collected on Draft Network Map**

Type of Feedback	Number of Comments Received During Comment Period
Online Feedback Form (including formal comments by municipalities or representatives)	5,771 respondents (16,827 open-ended comments)
Paper Feedback Form	61
Emails (including formal comments by municipalities or representatives)	887
Open Houses/Street Chats/Coffee Hours/etc.	499
Community Meetings	1,418
Public Hearings	176
Voicemails	228
Other (annotated images, operator surveys, etc.)	103
Petitions	8 petitions, with a total of 2,562 signatures

Online Feedback Form

In addition to accepting comments at both in-person and virtual events, the MBTA invited riders and other stakeholders to complete feedback forms about the Draft Network Map online or in-person. Individuals were asked to rate their support for the redesigned network, as well as specific neighborhoods, on a five-point scale—from “strongly agree” (5) to “strongly disagree” (1)—and to indicate how frequently they use the MBTA or visit or travel to a particular neighborhood. The feedback form provided spaces for respondents to comment on the draft network as a whole as well as specific neighborhoods and routes.

The feedback form was open from May 16 to August 3, 2022 and was available in nine languages: English, Spanish, Arabic, Chinese (Simplified), Chinese (Traditional), French,

Haitian Creole, Portuguese, and Vietnamese. Questions from the online form were also on the paper worksheets distributed at in-person meetings and events (see [Events & Meetings](#)).

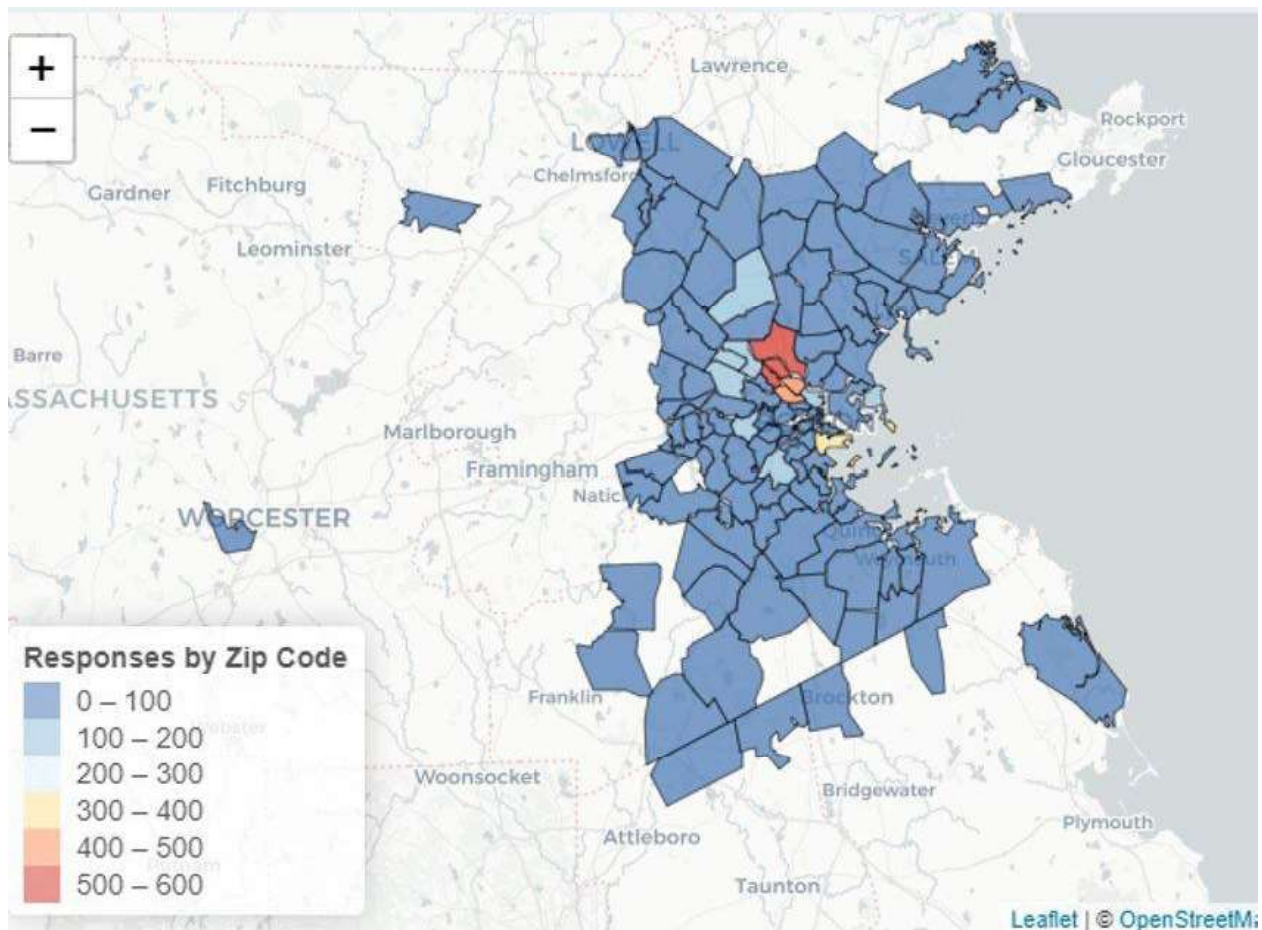
Figure 21 Online Feedback Form

The figure displays four versions of the online feedback form for the MBTA Bus Network Redesign project.
 1. **Desktop Version (Left):** A web browser interface with a language dropdown set to 'English'. It includes introductory text about the project, a section for general feedback with radio button options (Strongly Agree, Agree, Neither Agree nor Disagree, Disagree, Strongly Disagree), and a section for route-level feedback with a text input field for comments.
 2. **Mobile App Version (Second from Left):** A smartphone screen showing the same form layout, adapted for a smaller screen with a 'Back' button at the bottom.
 3. **Printed Version (Third from Left):** A printed worksheet with the same text and layout as the digital versions, featuring checkboxes for the general feedback section.
 4. **Completed Printed Version (Right):** A printed worksheet where the feedback has been filled out. The 'Strongly Agree' option is selected for the general statement, and a handwritten comment is visible in the route-level feedback section. The form also includes a return address for feedback: 'Bus Network Redesign, c/o Regina Villa Associates, P.O. Box 191537, Boston, MA 02196'.

The feedback form resulted in:

- 5,771 respondents
- 16,827 open-ended comments

Figure 22 Map of Online Feedback Form Responses by Zip Code



The top 10 zip codes for Online Feedback Form responses were: 02155—Medford (570), 02144—West Somerville (511), 02145—Winter Hill (464), 02143—Prospect Hill, Spring Hill (458), 02127—South Boston (338), 02474—East Arlington (170), 02152—Winthrop (152), 02129—Charlestown (149), 02474—Arlington (137), and 01801—Woburn (121).

Operator & Operations In-Reach

The MBTA BNRD project team conducted a robust feedback initiative to hear from Bus Operators directly about the proposed changes to the network. The team ultimately received 800+ comments from 135+ operators.

The goal of this initiative was to center bus operators as one of the key voices in this conversation. During these events, the project team visited MBTA bus garages to speak directly with operators about proposed routes. Operators provided critical insight on a variety of topics such as route length, roadway characteristics, and stop locations. Operator outreach was conducted at the following garages.

Table 7 Operator Outreach at Bus Garages

Bus Garage	Date	Timeframe
Cabot	Wednesday, June 22, 2022	9:00 AM–5:00 PM
Charlestown-Bennett	Thursday, July 14, 2022	9:00 AM–5:00 PM
Lynn	Wednesday, July 27, 2022	9:00 AM–3:00 PM
Quincy	Thursday, September 22, 2022	9:00 AM–12:30 PM
Arborway	Wednesday, October 12, 2022	9:00 AM–1:00 PM

Following the bus operator outreach activities, the MBTA team conducted a feedback session with the Operations Department at the Southampton Garage to discuss the inputs from the operator outreach activities. During this feedback session, the Service Planning and Bus Transformation teams presented an overview of key takeaways from the operator sessions, which included layover locations and associated infrastructure challenges, the availability of restrooms on routes, ADA accessibility and building time into schedules to accommodate onboarding and off-boarding for people using wheelchairs, and managing the challenges of congestion and difficult turns in bus routes.⁸ The Service Planning and Bus Transformation teams highlighted revisions in the Revised Network Map that responded to the comments received.

Events & Meetings

The Bus Network Redesign team organized and participated in a wide range of in-person and virtual events with different formats including open houses, street teams, briefings, community meetings, and hearings over the spring and summer of 2022.

⁸ ADA refers to the Americans with Disabilities Act of 1990, a Federal law that prohibits discrimination on the basis of disability. The ADA establishes requirements and regulations for access to public services for people with disabilities.

Table 8 Bus Network Redesign Events—Spring and Summer 2022

Type of Event	Number of Events	Number of Interactions ¹
Community Meetings	7	977
Open Houses	11	4,115
Street Teams	15	4,083
Briefings ²	77+	125 (estimated)
Hearings	2	265
TOTAL	112+	9,565

¹ Number of interactions include attendees who signed in at community meetings, open houses, briefings, and hearings, plus distributions of materials to riders at open houses and street teams.

² Includes municipal and legislative briefings as well as briefings with state agencies.

Community Meetings/Hearings

The MBTA held a series of community meetings and public hearings during the comment period. Community meetings were more interactive, often featuring breakout rooms where attendees could speak directly with project team members on specific topics. Public hearings focused on providing information and taking public comment rather than responding to questions.

During this period, the MBTA held a total of 9 meetings or hearings:

- A systemwide virtual community meeting to introduce the Draft Network Map
- Six virtual regional community meetings, which reviewed specific changes to routes in each of those regions
- Two systemwide public hearings, one virtual and one in-person

The systemwide meeting and virtual hearing included a presentation followed by a question-and-answer or public comment period. Each regional meeting included a presentation, interactive polling questions, and breakout rooms (to collect feedback from attendees) before a question-and-answer period.⁹ Attendees could ask questions or make comments either by typing them in the Q&A or Chat Feature or sharing them verbally in the breakout rooms or during the Question and Answer period.¹⁰

⁹ The May 19 Systemwide Public Meeting and June 26 Public Hearing were hosted via Zoom Webinar and did not include polling questions or breakout rooms.

¹⁰ With the exception of the May 19 and June 26 meetings, which used Zoom webinar and allowed written comments via Q&A Feature, all other virtual meetings used Zoom Webinar, so comments were submitted via Chat.

American Sign Language (ASL), Spanish, and Mandarin interpretation and Closed Captioning in English were provided at each of the virtual meetings, with Haitian Creole interpretation also available during the May 19, June 8, and July 26 meetings.

The in-person hearing included a presentation and public comment period, with project team members available to answer questions and collect feedback and comments. ASL, Spanish, and Mandarin interpretation were provided, and Neighborhood Fact Sheets were distributed at the in-person hearing.

Table 9 Community Meetings and Public Hearings for Draft Map

Location	Format	Date	Time	Number of Attendees ¹
Systemwide Public Meeting	Virtual, via Zoom	May 19, 2022	6:00 PM–7:30 PM	257
South Shore & South Suburbs	Virtual, via Zoom	May 24, 2022	6:00 PM–7:30 PM	38
Boston	Virtual, via Zoom	June 2, 2022	6:00 PM–7:30 PM	141
Mystic River & North Shore	Virtual, via Zoom	June 8, 2022	6:00 PM–7:30 PM	76
Inner Core	Virtual, via Zoom	June 16, 2022	6:00 PM–7:30 PM	182
Minuteman & Metro North	Virtual, via Zoom	June 22, 2022	6:00 PM–7:30 PM	195
Metrowest	Virtual, via Zoom	June 28, 2022	6:00 PM–7:30 PM	88
Systemwide Public Hearing	Virtual, via Zoom	July 26, 2022	6:00 PM–8:00 PM	205
10 Park Plaza Public Hearing	In-person	July 28, 2022	6:00 PM–8:00 PM	60 ²

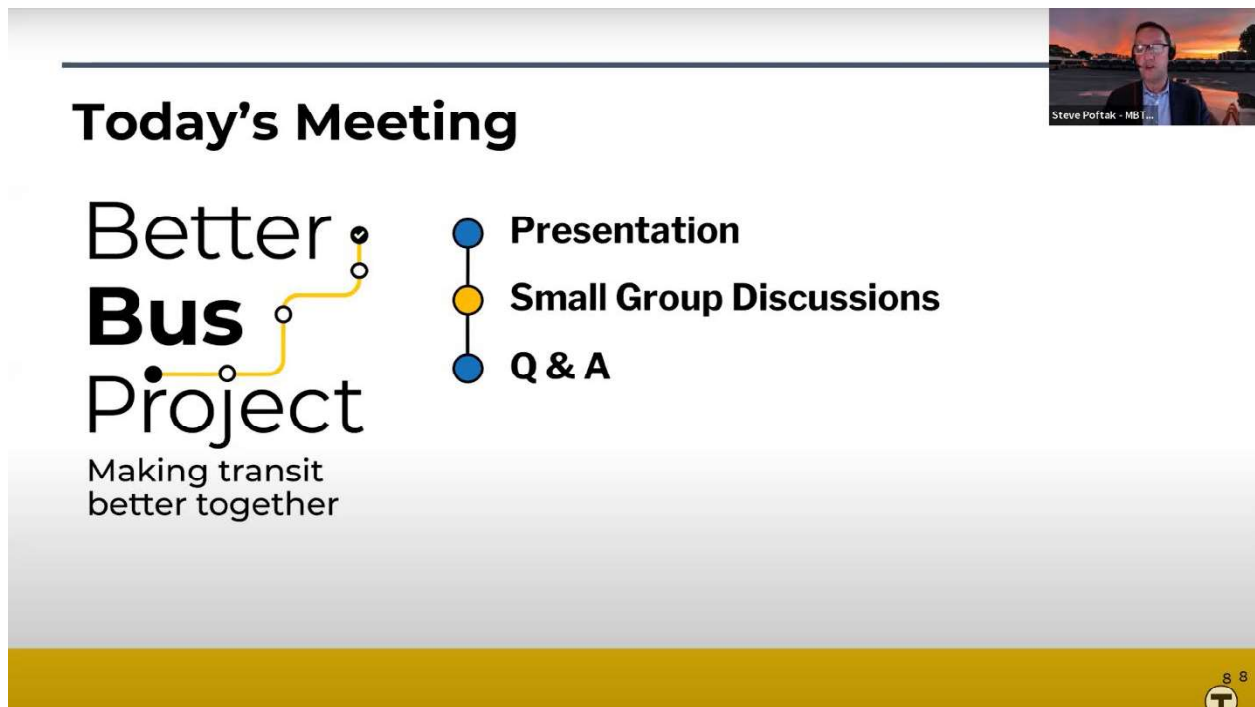
¹ Number of unique attendees.

² Only includes attendees who signed in.

The community meetings and public hearings resulted in:

- **1,242** attendees who signed in
- **1,594** total comments:
 - **1,418** comments shared at community meetings
 - **176** comments shared at public hearings

Figure 23 Bus Network Redesign Engaged with Participants at Virtual Meetings and Hearings between May and July 2022



Open Houses

Eleven open houses for BNRD were hosted at the Bolling Building in Nubian Square, Dewey Square, and other key bus stations. These locations were prioritized to reach bus riders impacted by the changes proposed in the Draft Network Map. The open houses provided the opportunity for riders to get their detailed and specific questions answered about the routes.

Station Open Houses implemented a more expansive system for collecting feedback system than the MBTA street teams. In addition to MBTA staff recording the verbal comments they received, the MBTA also provided access to the online survey and offered paper surveys to maximize the ways people could submit comment.

The open houses featured an informational table with project team staff, including Service Planners, and representatives from local community organizations in a centrally located area of the station for more in-depth discussions with riders. They also utilized the effectiveness of street teams to find riders where they are already waiting for a bus to share information about the project, including how to provide feedback and other upcoming events. One location was held onboard a parked bus with an informational table alongside. Neighborhood Fact Sheets tailored to each location and Network Change

Booklets were distributed at the open houses and an informational board (High-Frequency Map) was displayed.

The Bolling Building open house included informational and interactive stations, including informational stations about Better Bus Project, Bus Network Redesign, the high-frequency map, location-based services data, Bus Network Redesign implementation, and equity and Title VI as well as interactive stations with a Trip Planner tool, where attendees were able to use the online tool to see new transit options for their trips, and a mapping station, where attendees were able to review the Draft Network Map and provide comments.

Table 10 Open Houses for Draft Network Outreach

Location	Date	Time	Number of Network Change Booklets Distributed	Number of Neighborhood Fact Sheets Distributed
Nubian Station, Boston	May 18, 2022	2:00 PM–4:00 PM	297	25
Chelsea City Hall, Chelsea	May 26, 2022	5:00 PM–7:00 PM	279	10
Harvard Station, Cambridge	June 1, 2022	3:30 PM–5:30 PM	307	71
Quincy Center Station, Quincy	June 7, 2022	4:00 PM–6:00 PM	390	33
Dewey Square, Boston	June 14, 2022	11:00 AM–2:00 PM	169	16
Ashmont Station, Boston	June 23, 2022	4:30 PM–6:30 PM	234	24
Malden Center, Malden	June 30, 2022	4:30 PM–6:30 PM	309	42
Sullivan Station, Boston	July 7, 2022	3:30 PM–5:30 PM	636	61
Forest Hills, Boston	July 12, 2022	3:00 PM–5:00 PM	746	58
Bolling Building Open House	July 19, 2022	6:00 PM–8:00 PM	292	26
Wonderland Station, Revere	July 21, 2022	3:00 PM–5:00 PM	456	8

Materials distributed at Open Houses:

- 4,115 Network Change Booklets

Language	Number Distributed
English	3,792
Spanish	229
Simplified Chinese	45
Haitian Creole	18
Portuguese	31

- 373 Neighborhood Fact Sheets (366 English, 7 Spanish)¹¹

Neighborhood	Number of English Fact Sheets Distributed	Number of Spanish Fact Sheets Distributed
Allston, Brighton, and Brookline North	15	-
Arlington	12	-
Avon, Braintree, Brockton, Holbrook, Randolph, and South Weymouth	7	-
Back Bay, Beacon Hill, Downtown Boston, North End, South End, and West End	7	-
Boston	12	-
Burlington, Winchester, and Woburn	11	-
Cambridge	37	-
Charlestown/Somerville	37	-
Chelsea	22	3
Dorchester	51	1
Everett	7	1
Fenway, Kenmore, and Longwood Medical Area	9	-
Hingham, Hull, and North Weymouth	2	-
Hyde Park	7	-
Jamaica Plain and Mission Hill	17	-
Malden	30	1
Mattapan	6	-

¹¹ Fact sheets were more limited in their distribution as they were intended for reference rather than for hand-outs. The neighborhood booklets were intended to serve as the takeaway documents for members of the public.

Neighborhood	Number of English Fact Sheets Distributed	Number of Spanish Fact Sheets Distributed
Medford	7	-
Melrose	2	-
Milton and Quincy	20	-
Revere	7	-
Roxbury	36	1
Watertown	5	-

- **14 feedback forms** were filled out and returned to staff at the events

Language	Number Received
English	13
Spanish	1

Figure 24 11 Open Houses Were Held at the Bolling Building, Nubian Square, and Key MBTA Bus Stations from May through July 2022



Street Teams

The MBTA held 15 street teams, which encouraged one-on-one engagement with riders and community members, at bus stations and key destinations. The street teams were informal events held at bus stops and other MBTA stations across the entire network. During these events, multilingual MBTA staff would hand out flyers to riders and share information about the new BNRD initiative. Street teams allowed staff to stand where buses were dropping off passengers and in high traffic areas to ensure maximum visibility. The street teams were staffed by project team and MBTA staff as well as community partners.

Street teams were designed to spread awareness of the project and encourage attendance at BNRD community meetings to ask more detailed questions about the route changes. Staff also recorded verbal comments from conversations with the public.

Street teams distributed Network Change Booklets with the dates and locations of events, postcards, and Neighborhood Fact Sheets and encouraged riders to complete the online feedback form to share comments.

Figure 25 Neighborhood Change Booklet



Table 11 Street Teams Engagement

Location	Date	Number of Network Change Booklets Distributed	Number of Postcards Distributed	Number of Neighborhood Fact Sheets Distributed
Haymarket	May 11, 2022	500	-	-
Central Square (Cambridge)	May 25, 2022	196	139	-
Copley Station	June 9, 2022	88	35	-
Andrew Station	June 15, 2022	170	9	-
Longwood Medical Area	June 21, 2022	137	-	-
Kenmore Station	June 27, 2022	161	14	-

Location	Date	Number of Network Change Booklets Distributed	Number of Postcards Distributed	Number of Neighborhood Fact Sheets Distributed
Bellingham Square	June 28, 2022	396	124	6
Nubian Square Station	July 6, 2022	610	15	5
Maverick Station	July 11, 2022	435	69	2
Oak Grove Station	July 14, 2022	206	-	-
Art Beat (Davis Square)	July 16, 2022	151	27	-
Mattapan Station	July 18, 2022	183	-	-
Ruggles Station	July 20, 2022	497	30	1
Alewife Station	July 25, 2022	54	215	3
Wonderland Station	July 27, 2022	299	60	-

Materials Distributed at Street Teams:

- 4,083 Network Change Booklets

Language	Number Distributed
English	3,599
Spanish	477
Haitian Creole	5
Portuguese	2

- 737 postcards

Language	Number Distributed
English	549
Spanish	188

- 17 Neighborhood Fact Sheets

Neighborhood	Number of English Fact Sheets Distributed	Number of Spanish Fact Sheets Distributed
Cambridge	2	-
Charlestown/Somerville	1	-
Chelsea	4	2
Dorchester	3	-
East Boston and Winthrop	1	1
Roxbury	3	-

Briefings & Meetings

The MBTA provided a variety of briefings to community groups, legislators, municipalities, and state agencies to share information and promote community and interagency collaboration.

- 45+ meetings with municipal or state agency staff held with a total of 25+ municipalities or agencies to date
- 25+ meetings with legislators and elected officials held
- Meetings with **20+ community groups** to promote the virtual and in-person events as well as the Draft Network Map
- Participation in **13 “coffee hour” events** organized by the Mayor of Boston in different Boston neighborhoods

Outreach for Events & Feedback Form

The MBTA publicized the Draft Network Map, Bus Network Redesign events, and the comment period for the Draft Network Map through a variety of online and print channels.

Flyers

A Bus Network Redesign flyer for the May 19 virtual systemwide meeting was distributed to stakeholders via email and posted on the project website. It was available in nine languages: English, Spanish, Arabic, Chinese (Simplified), Chinese (Traditional), French, Haitian Creole, Portuguese, and Vietnamese.



Online Coverage & Social Media

There was a total of **919** mentions, with **443** unique authors, across all online coverage (blogs, Facebook, forums, Instagram, news, Reddit, Twitter) between May 1 and August 1, 2022.¹²

The MBTA posted on Facebook, Instagram, and Twitter to promote the virtual community meetings, station open houses, hearings, and online feedback form.

- **Twitter:**
 - There were **54** total mentions via the MBTA Twitter, including **47** tweets and **7** replies
 - There were **358** audience mentions and **138** retweets
 - There were **952,449** audience impressions
- **Facebook:**
 - **18** events were posted, with a total reach of **6,109** and **178** responses

¹² Posts that include a reference to the project, including posts tagging the project or mentioning the project by name.

- **Instagram:**
 - 2 posts with **649** total interactions, **633** total likes, **16** total comments, and a total reach of **14,575**
 - 2 stories posted with **3,109** total accounts reached and **3,268** total impressions

Figure 26 Social Media Posts for Draft Network Map

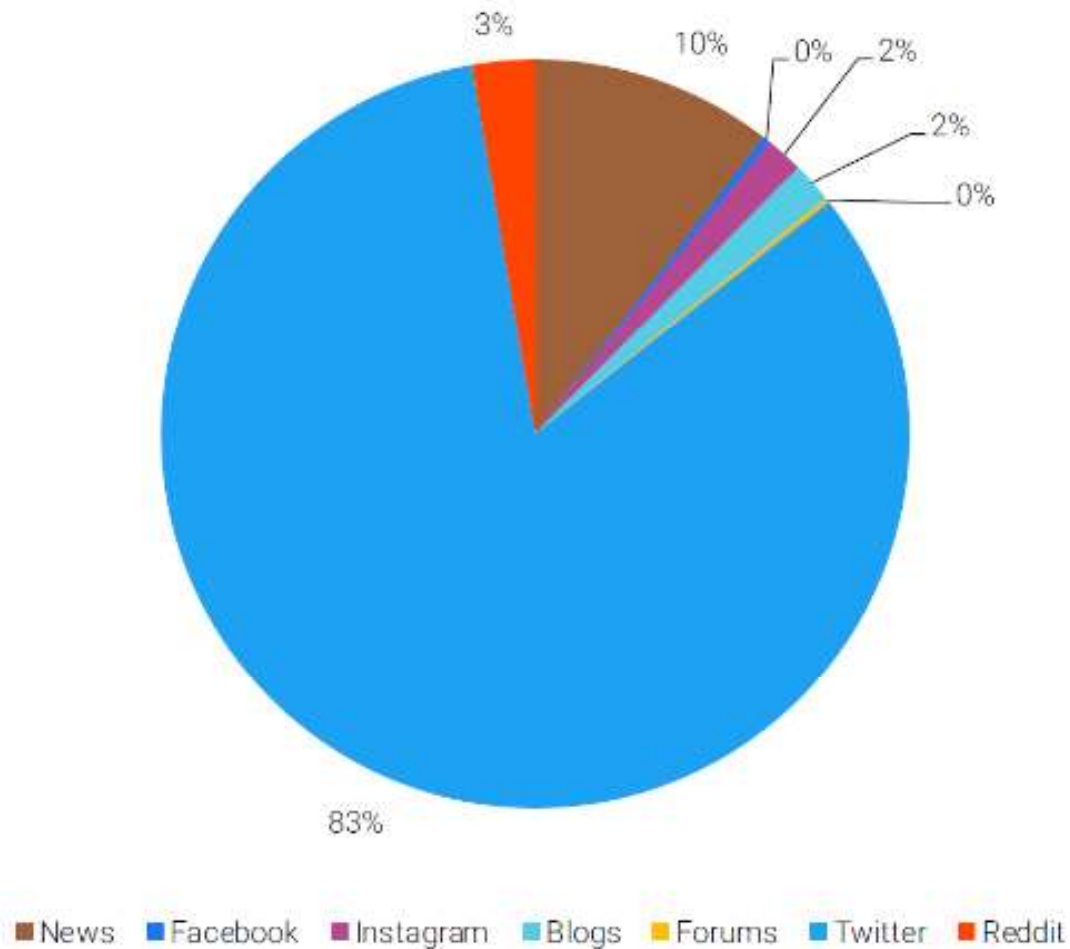
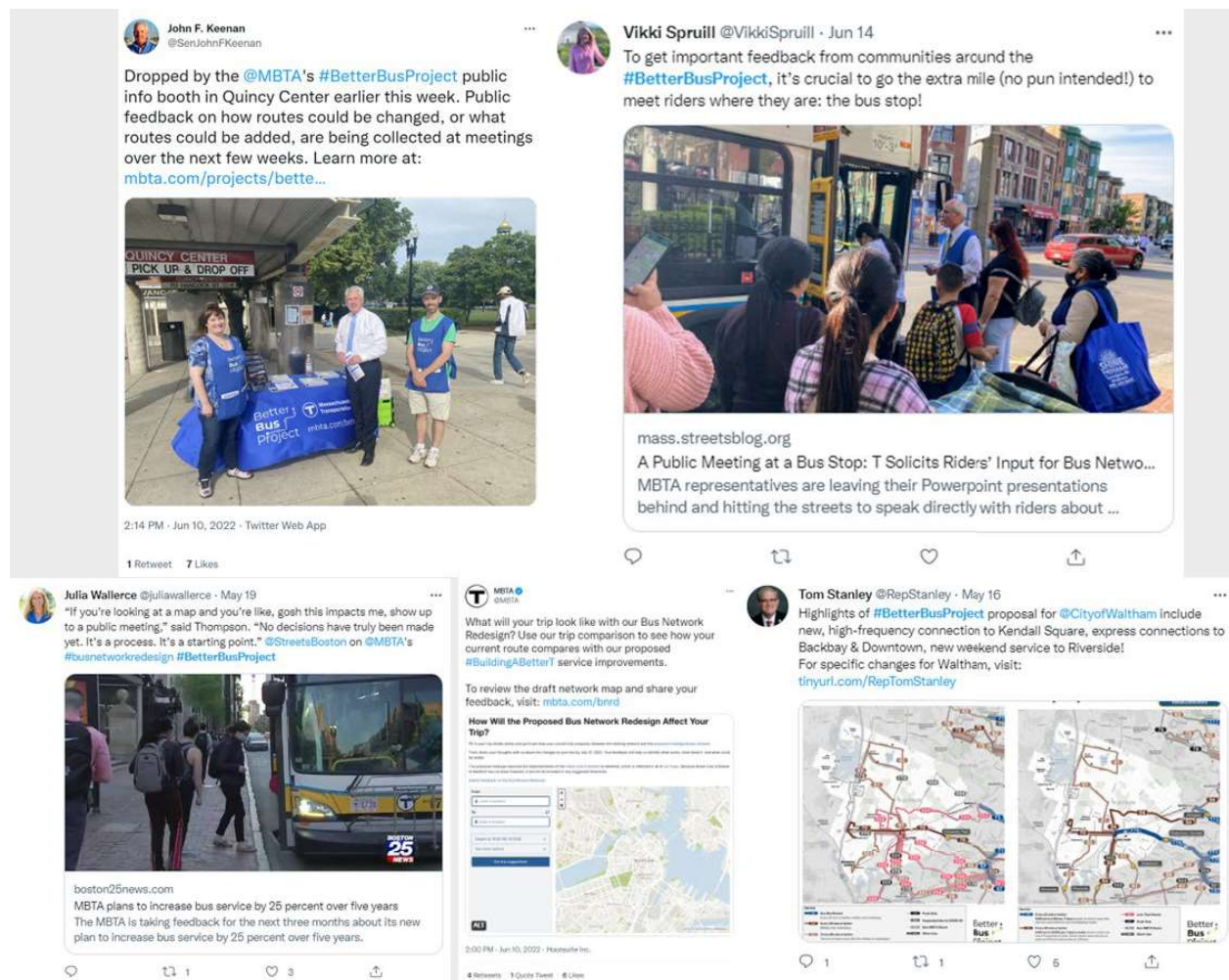


Figure 27 BNRD Social Media Posts



Traditional Media

The MBTA issued a media advisory about the Draft Network Map, events, and comment period on May 16, 2022. The MBTA also placed newspaper display advertisements (in multiple languages) throughout the comment period and issued Spanish-language 30-second radio advertisements, run by Real Media Group from June 13 through July 25, 2022.

Newspaper ads were placed in three rounds. The first round of display ads were placed in the following papers to advertise the May 19 virtual systemwide meeting and the feedback form:

- *Sampan*—Chinese, May 6, 2022
- *Everett Independent*—English, May 11, 2022

- *Portuguese Times*—Portuguese, May 11, 2022
- *Revere Journal*—English, May 11, 2022
- *Bay State Banner*—English, May 12, 2022
- *Chelsea Record*—English, May 12, 2022
- *Dorchester Reporter*—English, May 12, 2022
- *El Mundo*—Spanish, May 12, 2022
- *La Voz*—Spanish, May 12, 2022
- *Lynn Daily Item*—English, May 12, 2022
- *Vocero Hispano*—Spanish, May 13, 2022
- *Brockton Enterprise News*—English, May 17, 2022
- *Quincy Patriot Ledger*—English, May 17, 2022

The second round of display ads were placed in the following papers to advertise region-specific community meetings:

- *Brockton Enterprise News*—English, May, 19, 2022
- *Quincy Patriot Ledger*—English, May 19, 2022
- *Bay State Banner*—English, May 26, 2022
- *Dorchester Reporter*—English, May 26, 2022
- *Everett Independent*—English, June 1, 2022

MBTA Seeks Rider Input on Bus Routes + Service Proposals

We want to hear from you.
The MBTA's Bus Network Redesign is a once-in-a-generation opportunity to make bold improvements to the MBTA's bus network for the people that depend on it most.

WHEN: Thursday, May 18, 2022
6:00 – 7:30 PM

LOCATION: Virtual Public Meeting (Zoom)

PRE-REGISTER USING THIS LINK:
[MBTA.com/BNRDMeeting](https://www.mbtacom/bnrdmeeting)

PROJECT WEBSITE:
[MBTA.com/BNRD](https://www.mbtacom/bnrd)

Accommodations:
The public meetings are accessible to people with disabilities and those with limited proficiency in English. Accessibility accommodations and language services will be provided free of charge, upon request, as available. Such meetings include live interpretation in Spanish, French, and Vietnamese, closed captioning, and sign language. For more information or to request a reasonable accommodation or other language services, please e-mail BetterBusProject@MBTA.com or call 617-221-1202. Requests should be made at least two business days before a meeting.

La MBTA pide la opinión de pasajeros respecto a las rutas de autobús + propuestas de servicio

Queremos conocer su opinión.
Se trata de una oportunidad única en una generación de realizar mejoras de gran envergadura en la red de autobuses de MBTA para las personas que más la necesitan.

WHEN: Jueves, 19 de mayo de 2022
6:00 – 7:30 PM

LUGAR: Reunión pública virtual (Zoom)

PRESCRIPCIÓN:
Use este enlace:
[MBTA.com/BNRDMeeting](https://www.mbtacom/bnrdmeeting)

SITIO WEB DEL PROYECTO:
[MBTA.com/BNRD](https://www.mbtacom/bnrd)

Accommodations:
Los eventos públicos son accesibles para personas con discapacidades y con dominio limitado del inglés. Los servicios de accesibilidad y servicios de interpretación en español, francés y vietnamita, subtítulos en vivo, interpretación en señas y otros servicios de interpretación serán proporcionados de manera gratuita, según sea necesario. Para más información o para solicitar una acomodación razonable u otros servicios de idiomas, envíe un correo electrónico a BetterBusProject@MBTA.com o llame al 617-221-1202. Las solicitudes deben hacerse al menos dos días hábiles antes de una reunión.

MBTA Seeks Rider Input on Bus Routes + Service Proposals

We want to hear from you.
The MBTA's Bus Network Redesign is a once-in-a-generation opportunity to make bold improvements to the MBTA's bus network for the people that depend on it most.

WHEN: Thursday, June 2, 2022
6:00 – 7:30 PM

LOCATION: Virtual Public Meeting (Zoom)

ATTEND AN EVENT:
[MBTA.com/BNRDMeeting](https://www.mbtacom/bnrdmeeting)

PROJECT WEBSITE:
[MBTA.com/BNRD](https://www.mbtacom/bnrd)

Accommodations:
The public meetings are accessible to people with disabilities and those with limited proficiency in English. Accessibility accommodations and language services will be provided free of charge, upon request, as available. Such meetings include live interpretation in Spanish, French, and Vietnamese, closed captioning, and sign language. For more information or to request a reasonable accommodation or other language services, please e-mail BetterBusProject@MBTA.com or call 617-221-1202. Requests should be made at least two business days before a meeting.

- *Revere Journal*—English, June 1, 2022
- *Chelsea Record*—English, June 2, 2022
- *Lynn Daily Item*—English, June 2, 2022

The third round of display ads were placed in the following papers to advertise the public hearings:

- *Portuguese Times*—Portuguese, July 13, 2022
- *La Voz*—Spanish, July 14, 2022
- *Vocero Hispano*—Spanish, July 15, 2022
- *Sampan*—Chinese, July 22, 2022

MBTA-Systemwide Advertisement Campaign

The MBTA placed advertisements across a variety of platforms between May 16 and July 31, 2022 to notify riders of the Draft Network Map and public participation opportunities. The following types of ads were placed:

- **Digital Billboards:** Digital billboards ran on 78 digital billboards in Boston, Braintree, Chelsea, Everett, Lynn, Malden, Medford, Peabody, Revere, Somerville, Wakefield, and Woburn from June 1 through July 31, 2022.

Figure 28 One Version of the BNRD Digital Billboards



- **Digital Triptychs:** Digital signs in MBTA stations across the system ran from May 26 through July 31, 2022.

Figure 29 BNRD Digital Station Signs in English, Spanish, and Simplified Chinese



- **E-ink Signs:** Ads on e-ink signs across the system ran from May 16 through July 27, 2022.

Figure 30 BNRD E-ink Sign that Was Displayed Across the System



- **Car Cards & Posters:** 1,087 11"x28" car cards and 300 22"x21" signs were posted on buses across the system starting June 1, 2022.

Figure 31 BNRD Car Card, in English and Spanish



11"x28" cards

Figure 32 BNRD Poster that was Posted on Buses across the System

The poster features the MBTA logo and 'Better Bus Project' branding. It includes a photo of a bus and a table of community meetings. The text reads: 'What is Bus Network Redesign? This is a once-in-a-generation opportunity to make bold improvements to the MBTA's bus network for the people that depend on it most. We've developed a new draft network map that creates more all-day service, more service in busy neighborhoods, and new connections to more places.'

COMMUNITY MEETINGS
Join us at a virtual or in-person community meeting to learn more about the draft network map and let us know what you think.

LOCATION	DATE	TIME
SYSTEMWIDE Virtual via Zoom	May 19	6:00 - 7:30 PM
SOUTH SHORE & SOUTH SUBURBS Virtual via Zoom	May 24	6:00 - 7:30 PM
BOSTON Virtual via Zoom	June 2	6:00 - 7:30 PM
MYSTIC RIVER & NORTH SHORE Virtual via Zoom	June 8	6:00 - 7:30 PM
INNER CORE Virtual via Zoom	June 16	6:00 - 7:30 PM
MINUTEMAN & METRO NORTH Virtual via Zoom	June 22	6:00 - 7:30 PM
METROWEST Virtual via Zoom	June 28	6:00 - 7:30 PM
IN-PERSON OPEN HOUSE at Bruce C. Bolling Municipal Building, 2300 Washington Street, Boston	July 19	6:00 - 8:00 PM
PUBLIC HEARING Virtual via Zoom	July 26	6:00 - 8:00 PM
IN-PERSON PUBLIC HEARING Transportation Building, 2nd Floor, 10 Park Plaza, Boston	July 28	6:00 - 8:00 PM

We can't do this without you.
You can provide feedback about the draft network in a variety of ways:
• Attend a virtual public meeting or station open house.
• Provide feedback via our online feedback form at MBTA.com/BNRDfeedback.
Available in:
English, Spanish (Español), Arabic (العربية), Chinese - Simplified (汉语), Chinese - Traditional (漢語), French (Français), Haitian Creole (Kreyòl Ayisyen), Portuguese (Português), and Vietnamese (Tiếng Việt).
Visit the website to learn more and view the draft network map: MBTA.com/BNRD

22"x21" posters

- **Onboard bus announcements:** Announcements encouraging riders to provide feedback on the draft network were played over the PA system on MBTA buses from July 15 through July 31, 2022.

Email Blasts

The project team sent a kickoff/systemwide meeting announcement, meeting series announcement, materials and feedback form available announcement, then reminder emails every week May through July 2022; in total, 14 e-blasts were sent to numerous riders, community organizations, and other stakeholders. These e-blasts had an average open rate of 43 percent and an average click rate of 7 percent.

- **3,701** email subscribers in first email blast (April 28, 2022)
- **4,772** email subscribers in final email blast (July 29, 2022)

Table 12 BNRD Email Blasts—April to July 2022

Date Sent	Subject Line	Number of Recipients	Open Rate	Click Rate
4/28/2022	Better Bus Project: Bus Network Redesign Public Meeting on May 19	3,701	43%	11%
5/5/2022	Better Bus Project: Upcoming Regional Public Meetings	3,659	42%	8%
5/16/2022	Better Bus Project: New Bus Network Map Draft Now Available	3,657	45%	24%
5/23/2022	Better Bus Project: New Bus Network Map Draft—Upcoming Meetings (Week of May 23)	3,681	43%	8%
5/31/2022	Better Bus Project: New Bus Network Map Draft—Upcoming Meetings (Week of May 30)	3,806	43%	8%
6/6/2022	Better Bus Project: New Bus Network Map Draft—Upcoming Meetings (Week of June 6)	3,918	43%	5%
6/13/2022	Better Bus Project: New Bus Network Map Draft—Upcoming Meetings Week of June 13	4,000	42%	5%
6/21/2022	Better Bus Project: New Bus Network Map Draft—Upcoming Meetings Week of June 20	4,140	43%	5%
6/27/2022	Better Bus Project: New Bus Network Map Draft—Upcoming Meetings Week of June 27	4,292	43%	5%
7/1/2022	Better Bus Project: New Bus Network Map Draft—Upcoming Meetings Week of July 4	4,348	43%	3%
7/11/2022	Better Bus Project: New Bus Network Map Draft—Upcoming Meetings Week of July 11	4,353	44%	4%

Date Sent	Subject Line	Number of Recipients	Open Rate	Click Rate
7/18/2022	Better Bus Project: New Bus Network Map Draft—Upcoming Meetings Week of July 18	4,346	43%	5%
7/25/2022	Better Bus Project: New Bus Network Map Draft—Upcoming Meetings Week of July 25	4,474	44%	5%
7/29/2022	Better Bus Project: New Bus Network Map Draft—Comment Period Ending July 31	4,772	45%	5%

Compiling and Reviewing Public Feedback

The MBTA Service Planning team was deeply involved in the feedback process. Team members participated in public outreach events in order to hear directly from public meeting attendees, riders at station pop-ups, elected officials and municipal representatives, and other key stakeholders on the primary issues of concern. In addition, comments from the Online Feedback Form, letters, emails, voicemails, operator feedback, and other related sources were compiled into a unified comment database. More than 80 percent of total comments received came through the Online Feedback Form, while another 10 percent came through the public/community meetings.

The comment database contained all comments received through the public outreach process. Each comment in the database was tagged with the following criteria:

- **Source:** The source of public input for the comment.
 - Email, online survey, live meeting, paper survey, petition, voicemail, or other.
- **Route/neighborhood:** The route or neighborhood that the comment applied to.
 - Consideration was given to the fact that a neighborhood could receive service from multiple routes and that a route could travel through multiple neighborhoods.
 - When comments only referred to a neighborhood, the comment was tagged for all routes that service the neighborhood.
- **Attitude:**
 - Supportive: Demonstration of support for a proposed network change.
 - Neutral: General comment, with no positive or negative opinion offered.

- Unsatisfied: Request for additional adjustments or revisions.
- Hardship: Identification of a challenge, barrier, or other hardship that would impact the commenter’s access to transit service under current OR future network design.
- Other.
- **Topic(s):**
 - Bus stop: A comment relating to the condition of bus stops along the affected bus routes or in the neighborhood (safety, accessibility, visibility, cleanliness, etc.).
 - Path/routing: A comment relating to the path of travel for the affected bus route(s) or in the neighborhood.
 - Rapid transit connection: A comment relating to accessing or transferring between the bus network and the rapid transit network (Red/Orange/Blue/Green/Silver lines).
 - Connection to key destinations: A comment relating to the ability to travel to or from important destinations along or adjacent to the affected bus routes.
 - New connections: A comment requesting additional connections to origins and/or destinations under the current or future network.
 - Simpler network: A comment requesting fewer changes in service span, service frequency, route design, etc.
 - Contains specific change suggestion: A comment names a specific location, such as a rapid transit station, a bus stop, or a destination; or, a specific part of the route, such as a turn, a street, or an intersection.
 - Equity, low income, minority populations: A comment discusses impacts on low-income or minority populations.
 - Elderly: A comment discusses impacts on elderly populations.
 - Frequency / span: A comment discusses changes to frequency or span of service along the affected bus routes or in the neighborhood.
 - All day service: A comment requests all-day service for a bus route or a neighborhood.

- Accessibility (limited mobility): A comment discusses impacts related to transit access for people with limited mobility.
- Vehicles, bus lanes, other: A comment discusses changes to vehicles, bus lanes, or other types of infrastructure involved in bus service provision.

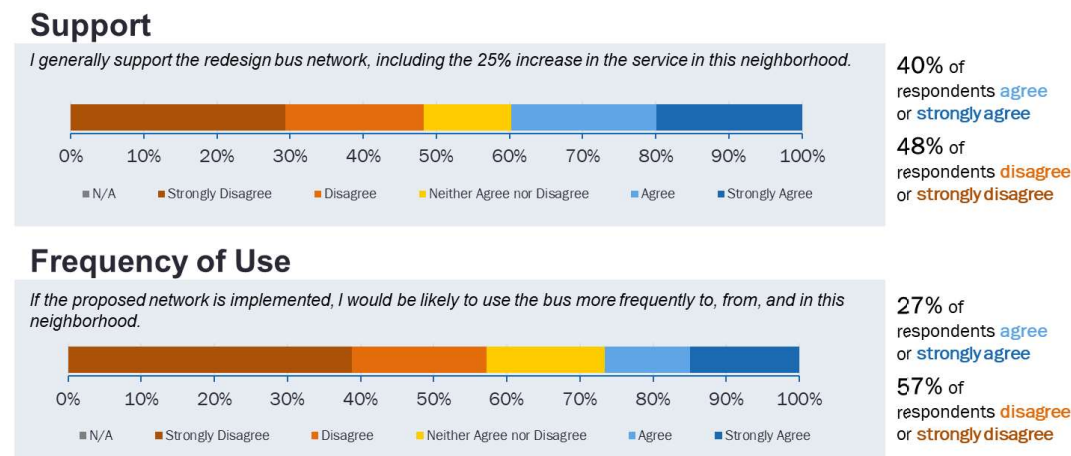
The database was created and used by the Service Planning team in both Excel format and through an R Shiny dashboard, which allowed for searching and filtering of comments along with charts and summary statistics of quantitative feedback.

Summary of Feedback Received About Draft Network

Over 20,000 comments were received during the draft network public outreach process. The biggest source was the online feedback form, which had over 5,000 respondents and over 16,000 total comments about the draft network.

The online feedback form asked respondents to say whether they agree or disagree with the statement “I generally support the redesigned bus network, including the 25 percent increase in the service in this neighborhood.” On this question, 40 percent of respondents said they agree or strongly agree, 48 percent selected disagree or strongly disagree, and the remaining 12 percent said neither agree or disagree. A second question asked if the respondent agreed or disagreed with the statement “If the proposed network is implemented, I would be likely to use the bus more frequently to, from, and in this neighborhood.” 27 percent of respondents agreed or strongly agreed, while 57 percent disagreed or strongly disagreed. These results are shown in Figure 33.

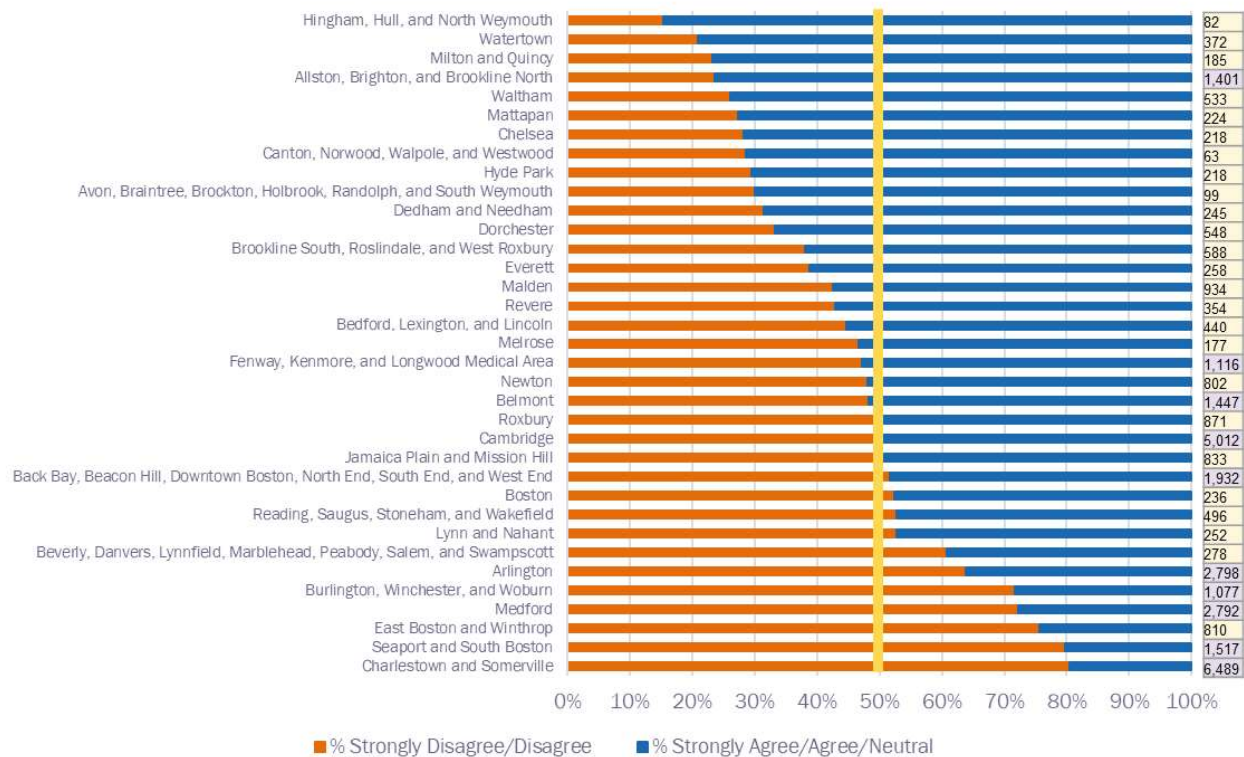
Figure 33 Online Feedback Form Responses



Source: Online Feedback Form, 5,068 respondents

Responses varied significantly by neighborhood, both in quantity and in level of support. Figure 34 displays support and total number of comments by neighborhood. Neighborhoods with the highest share of positive support included Hingham, Hull, and North Weymouth; Watertown; Milton and Quincy; Allston, Brighton, and Brookline North; Waltham, Mattapan, and Chelsea. On the other end of the spectrum, strong disagreement was heard in the towns or neighborhoods of Somerville and Charlestown; Seaport and South Boston; East Boston and Winthrop; Medford; Burlington, Winchester, and Woburn; and Arlington. Neighborhoods with the highest volume of comments were correlated with stronger negative views on the redesign proposal.

Figure 34 Online Feedback Form Support for Redesigned Bus Network by Neighborhood



The most frequently commented-on routes in the online feedback form were similarly concentrated in a handful of neighborhoods. The top ten most commented routes are shown in Table 13.

Table 13 Ten Most Frequently-Commented Routes (Online Feedback Form)

Route	Number of Comments
Route 87 (Somerville, Arlington)	531
Route 89 (Somerville)	510
Route 88 (Somerville)	464
Route 80 (Arlington, Medford, Somerville)	314
Route 96 (Medford, Somerville, Cambridge)	219
Route 39 (Jamaica Plain, Back Bay)	216
Route 94 (Medford, Somerville)	209
Route 90 (Somerville)	207
Route 11 (South Boston)	173
Route 354 (Burlington, Woburn, Medford)	148

Across all comments—including the online feedback form, public meeting comments, emails, and all other sources—critical feedback can be grouped into a few general themes.

- Concerns from public, elected officials, municipal staff, etc. on **specific route changes, connections, and new routes** proposed in the May 2022 draft network. In particular, routes with this type of feedback included:
 - Boston: 11, 39, 47, 55
 - Somerville/Medford/Arlington: 80, 87, 88, 89, 96
 - Cambridge: 74, 83, 87
 - Chelsea: 104, 112
 - Woburn, Burlington, Medford: 354 (Express bus)
 - Newton: 505
- Desire to maintain **one-seat rides** and/or **front-door access to medical facilities, senior housing, etc.** Routes with significant feedback of this type included:
 - Boston: 8, 11, 12, 18, 55, 39
 - Waltham: 53

- Newton: 54
- Malden/Everett: 97, 99
- Chelsea: 112
- Milton/Quincy: 222
- **Route length and reliability concerns.** This feedback primarily came from municipalities and operators, and in particular applied to routes 15, 39, 66, 90, 133, and 238.
- **Connectivity to the MBTA system.** Many respondents wanted routes to be connected to the rest of the MBTA system, including commuter rail stations (136, 238), rapid transit stations (60, 66, 87, 90, 94), and even ferry terminals (119, 220). Maintaining or extending connectivity to the Green Line Extension was particularly popular among respondents from Arlington, Somerville, Medford, and Belmont.

However, many respondents pushed back against route cuts designed to replace one-seat trips to key destinations with transfers to rapid transit stations (11, 39). They frequently raised accessibility issues with these transfer points, such as having to navigate staircases that become icy in the winter.

This collective feedback was integrated into a revised, final bus network redesign proposal as described in Section 5.

Fall 2022 Outreach—Revised Network

After the Summer 2022 outreach period, the MBTA evaluated the feedback provided and made changes to more than half the bus routes in the Draft Network Map released in May 2022. The changes were based on a variety of considerations, including more than 20,000 comments received in May, June, and July and addressed issues to:

- Improve access to hospitals, senior centers, and other destinations.
- Reduce walk distances for older adults and other riders in locations with uneven ground or sidewalks.
- Preserve existing one-seat rides to many destinations.
- Balance resources and stay within the limit of buses available during peak times.

Section 5 includes additional discussion of how the Revised Network Map was produced. The MBTA hosted outreach events in fall 2022 to present a Revised Network Map for implementation and answer questions from the public.

Revised Network

The MBTA made changes to 85 of the 133 bus routes in the May proposal. All route changes fell within one of the following categories:

- Routes brought back.
- Routes with new travel paths for better connections to more places.
- Routes with frequency and service changes.
- Routes added to the revised bus network that were not in the May proposal.
- Routes removed from the revised bus network that were in the May proposal.

The Revised Network Map still increases service by 25 percent across the network and doubles the number of high-frequency corridors.¹³



Materials

Summary of Changes Table

The MBTA created a Summary of Changes, which provided detailed information for each route throughout the bus network, including service hours and frequency, route name, and what was changed from the May 2022 proposal. The Summary of Changes table was posted on the webpage for the Revised Network Map, including downloadable PDFs. The table was available in nine languages: English, Spanish, Arabic, Chinese (Simplified), Chinese (Traditional), French, Haitian Creole, Portuguese, and Vietnamese.

¹³ Buses running every 15 minutes or better, all day, every day.

Figure 35 English and Spanish Versions of the Summary of Changes

Route	Service Hours/Frequency	Route Name	What we changed from the May 2022 Proposal
T1	Every 15 minutes or better 5 AM to 1 AM Seven days per week	Harvard Sq to Nubian Sq via Back Bay	No change since May proposal
T7	Every 15 minutes or better 5 AM to 1 AM Seven days per week		
T8	Every 15 minutes or better 5 AM to 1 AM Seven days per week		
T9	Every 15 minutes or better 5 AM to 1 AM Seven days per week		
10	Every 30 minutes or better 5 AM to 10 PM Every 45 minutes or better 10 PM to 1 AM Seven days per week		
11	Every 30 minutes or better 6 AM to 9 AM and 4 PM to 7 PM weekdays Every 60 minutes or better 6 AM to 7 PM Every 90 minutes or better 7 PM to 1 AM Seven days per week		
T12	Every 15 minutes or better 5 AM to 1 AM Seven days per week		
14	Every 60 minutes or better 6 AM to 7 PM Every 90 minutes or better 7 PM to 10 PM Seven days per week		
T15	Every 15 minutes or better 5 AM to 1 AM Seven days per week		

Ruta	Horario de servicio/ Frecuencia	Nombre de la ruta	Qué cambios hemos realizado desde la propuesta de mayo de 2022
T1	Cada 15 minutos o menos 5 AM a 1 AM Siete días a la semana	Harvard Sq a Nubian Sq via Back Bay	Sin cambios desde la propuesta de mayo
T7	Cada 15 minutos o menos 5 AM a 1 AM Siete días a la semana	Sullivan a City Point via Charlestown, North Station y South Station	Sin cambios desde la propuesta de mayo
T8	Cada 15 minutos o menos 5 AM a 1 AM Siete días a la semana	Harbor Point a Copley	Re-enrutamiento vía Harrison Ave, E Concord St y E Newton St en lugar de Albany St y Malden St para que las paradas estén más cerca del Boston Medical Center
T9	Cada 15 minutos o menos 5 AM a 1 AM Siete días a la semana	City Point a Copley via Broadway	Sin cambios desde la propuesta de mayo
10	Cada 30 minutos o menos 5 AM a 10 PM Cada 45 minutos o menos 10 PM a 1 AM Siete días a la semana	City Point a Ruggles via Andrew	Sin cambios desde la propuesta de mayo
11	Cada 30 minutos o menos 6 AM a 9 AM y 4 PM a 7 PM días hábiles Cada 60 minutos o menos 6 AM a 7 PM Cada 90 minutos o menos 7 PM a 1 AM Siete días a la semana	City Point a Tufts Medical Center	Extensión a Washington St y Kneeland St para acceso directo al Tufts Medical Center; servicio extendido a la 1AM.
T12	Cada 15 minutos o menos 5 AM a 1 AM Siete días a la semana	Brookline Village a Seaport via Longwood Medical Area, Nubian Sq y Andrew	Re-enrutamiento vía Mass Ave, Washington St y Nubian Sq para mejorar el acceso al Boston Medical Center y ofrecer una conexión adicional desde Nubian Sq hasta el Boston Medical Center; se conecta a la Orange Line en el Roxbury Crossing en lugar de Ruggles; consulte la ruta T47 para el Longwood Medical Area - Ruggles
14	Cada 60 minutos o menos 6 AM a 7 PM Cada 90 minutos o menos 7 PM a 10 PM Siete días a la semana	Roslindale Sq a Nubian Sq via American Legion Hwy	Restablecimiento de la ruta existente desde Roslindale Sq hasta Nubian Sq; consulte la ruta 41 para el servicio de Heath St a Nubian Sq.
T15	Cada 15 minutos o menos 5 AM a 1 AM Siete días a la semana	Fields Corner a Ruggles via Nubian Sq	Finalización de la ruta en Ruggles en lugar de Oak Sq; consulte la ruta 65 para la conexión de Ruggles a Brighton.

Bus Network Redesign Online Content & Website

The MBTA developed a separate [webpage](#) to house the new content about the Revised Network Map, including information about the revised network and the Summary of Changes table, with downloadable PDFs in nine languages, and how stakeholders could share their comments. Also included on this webpage were a [static map](#), to view changes at a regional level, and an [interactive map](#) on the Remix platform, where visitors could select specific routes for detailed information at the street level.

Table 14 BNRD Webpage Statistics

Webpage	Number of Pageviews (October 12–November 30 2022)	Average Time on Page (Seconds)
mbta.com/bnrd	12,008	51.04
mbta.com/projects/bus-network-redesign/update/revised-bus-network-map (Revised Network Map page)	26,699 ¹	197.41
mbta.com/bnrdneighborhoods (proposal page)	6,200	88.17

¹ The Revised Network Map page did not go live until October 27, so numbers reflected here are for October 27 through November 30.

Figure 36 BNRD Webpage—Pageviews During Fall Outreach Period (October 12–November 30)

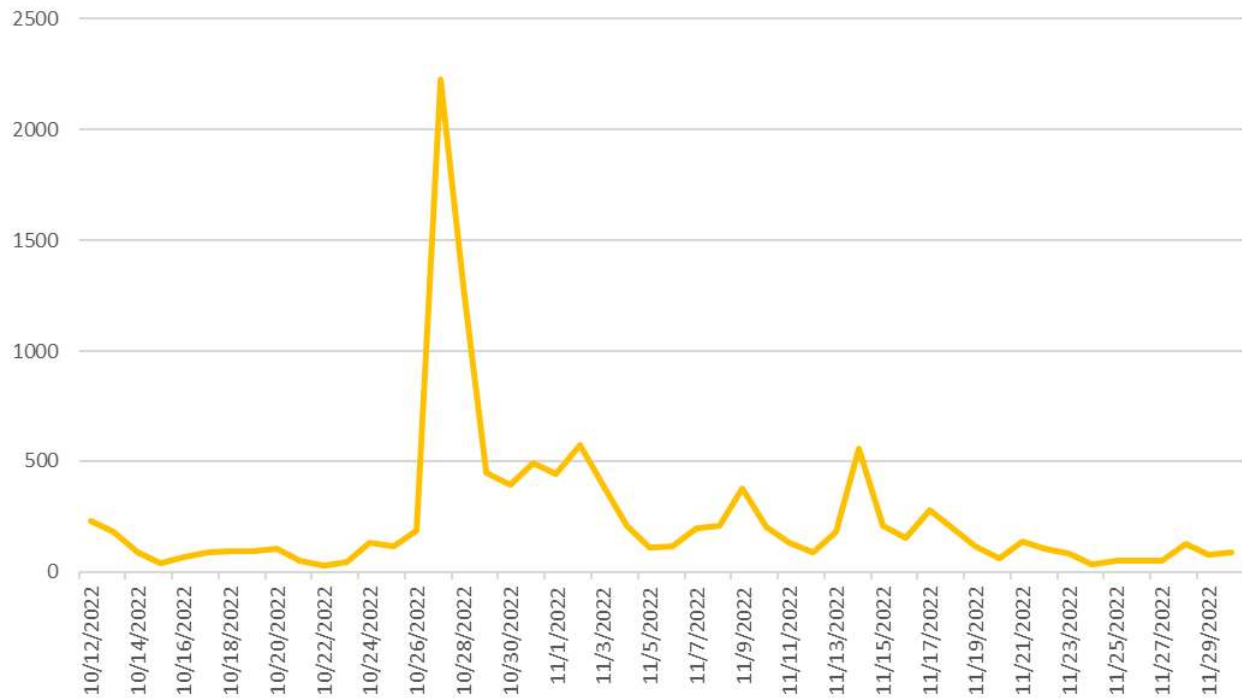


Figure 37 BNRD Revised Network Map Webpage—Pageviews During Fall Outreach Period (October 27–November 30)¹⁴

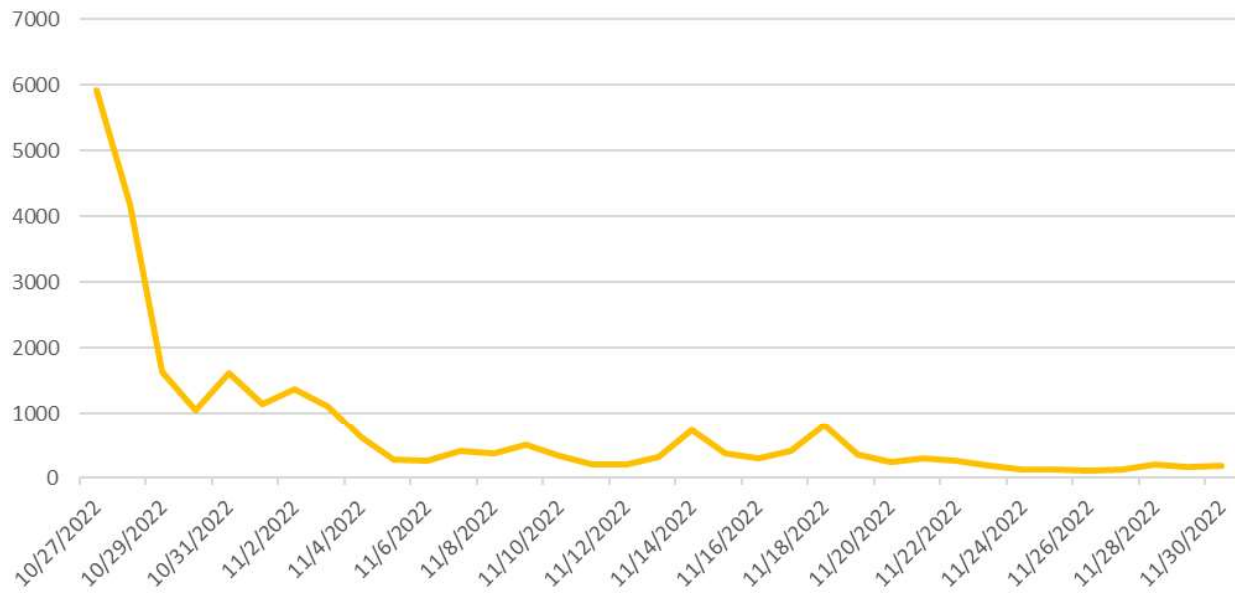
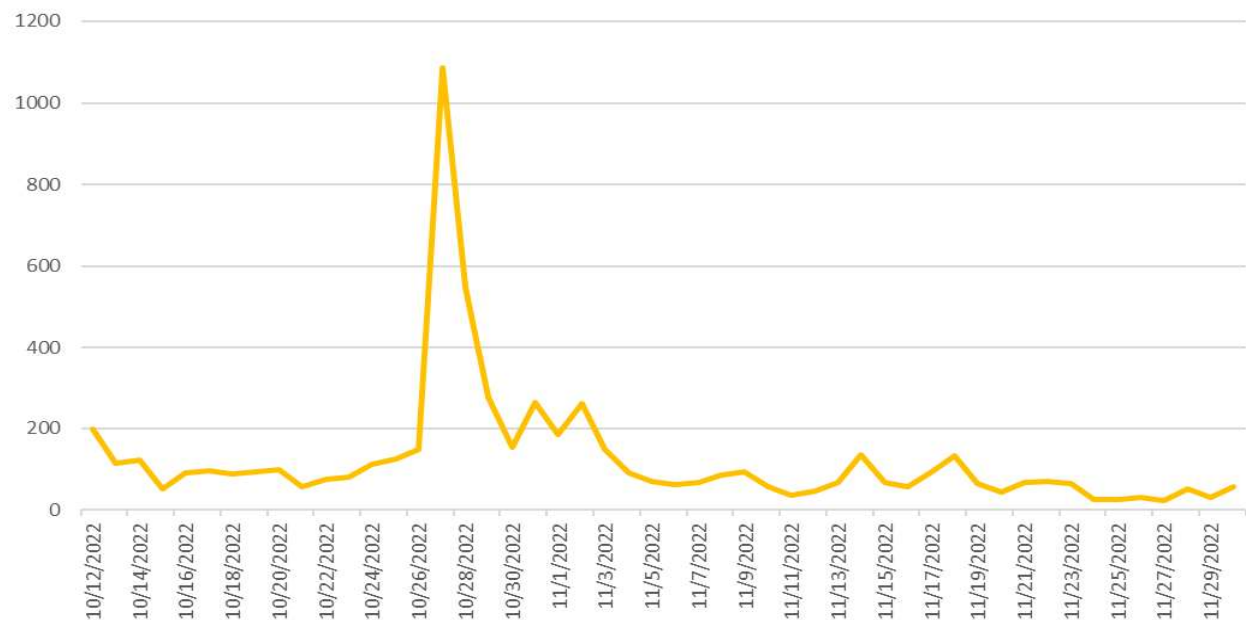


Figure 38 BNRD Proposal Webpage—Pageviews During Fall Outreach Period (October 12–November 30)



¹⁴ The Revised Network Map page did not go live until October 27, so numbers reflected here are for October 27 through November 30.

Events & Meetings

Virtual Community Meetings

The MBTA held two virtual (via Zoom) community meetings about the Revised Network Map. Each meeting included a presentation and breakout rooms (to provide detailed information about different regions of the bus network) before a question-and-answer period. Attendees could ask questions or make comments either by typing them in the Chat Feature or sharing them verbally in the breakout rooms or during the Question and Answer period. American Sign Language (ASL), Spanish, and Mandarin interpretation and Closed Captioning in English were provided at each of the virtual meetings.

Table 15 Virtual Community Meetings on Revised Network Map

Date	Time	Number of Attendees ¹
November 2, 2022	6:00 PM–9:00 PM	403 ²
November 14, 2022	6:00 PM–9:00 PM	299

¹ Number of unique attendees; includes staff.

² The November 2 meeting attendance was restricted by a 300-attendee limit on the Zoom account.

The virtual meetings resulted in **702** attendees who signed in.

Briefings & Meetings

During the Fall 2022 comment period, the MBTA provided a variety of briefings to community groups, legislators, municipalities, and state agencies to share information and promote community and interagency collaboration.

- 16+ meetings with municipal staff held with a total of 12 municipalities.
- Six+ meetings with legislators held.
- **Five+ meetings with state agencies** held, including Boston Region MPO, Massport, DCR, and MassDOT.
- Meetings with **eight+ community groups** to promote the virtual and in-person events as well as the Draft Network Map.

Opportunities for Feedback

In addition to accepting comments at the virtual events, the MBTA invited riders and other stakeholders to share comments about the Revised Network Map with the Implementation Team via an [online comment form](#). When the comment form closed on December 30, there had been 761 comments submitted.

Outreach for Events

The MBTA publicized the Revised Network Map and Bus Network Redesign events through a variety of online and print channels.

Flyers

A Bus Network Redesign flyer for the November 2 virtual meeting was distributed to stakeholders via email and posted on the project website. It was available in nine languages: English, Spanish, Arabic, Chinese (Simplified), Chinese (Traditional), French, Haitian Creole, Portuguese, and Vietnamese.

Online Coverage & Social Media

There was a total of **502** mentions, with **263** unique authors, across all online coverage (blogs, Facebook, forums, Instagram, news, Reddit, Twitter) between October 1 and December 31, 2022.¹⁵

The MBTA posted on Facebook, Instagram, and Twitter to promote the Revised Network Map and virtual public meetings.

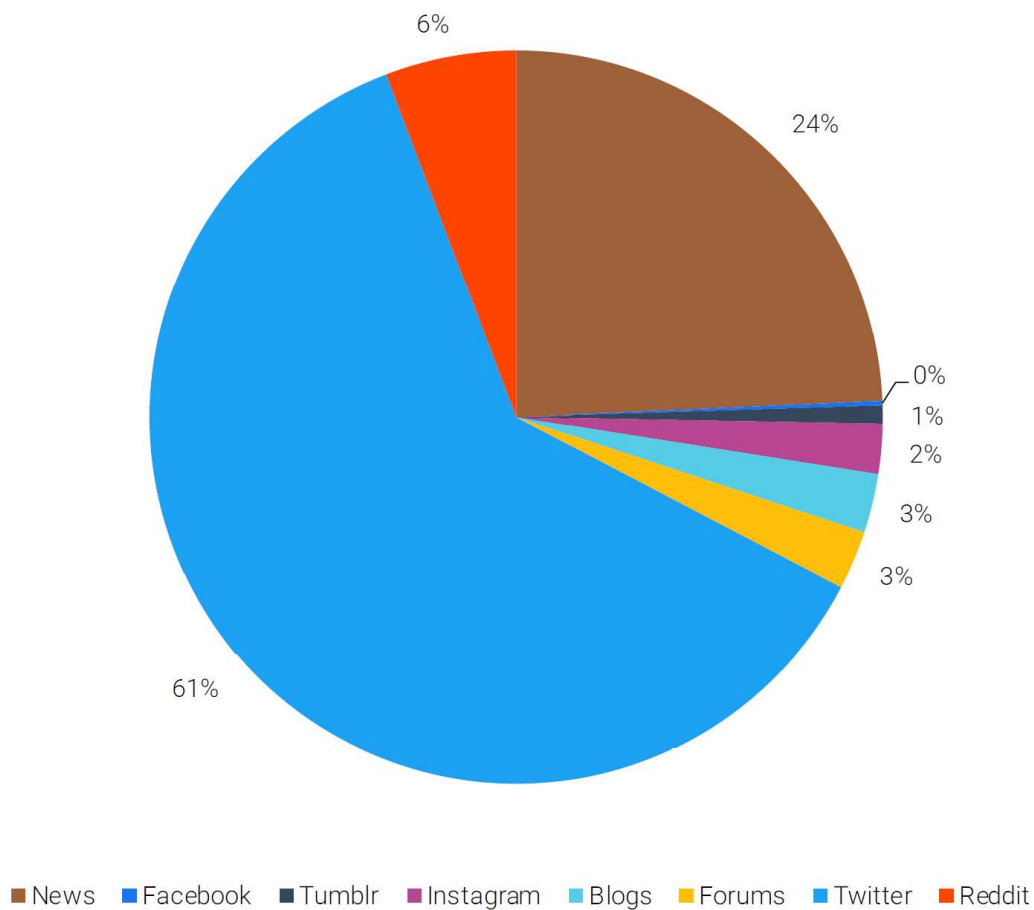
- **Twitter:**
 - There were **7** total mentions via the MBTA Twitter
 - There were **145** audience mentions and **32** retweets
 - There were **414,711** audience impressions



¹⁵ Posts that include a reference to the project, including posts tagging the project or mentioning the project by name.

- **Facebook:**
 - 3 events were posted, with a total reach of **1,176** and **35** responses
- **Instagram:**
 - 1 post with **774** total interactions, **746** total likes, **28** total comments, and a total reach of **17,135**
 - 3 stories posted with **4,619** total accounts reached and **4,654** total impressions

Figure 39 Social Media Posts for Revised Network Map



Traditional Media

The MBTA issued media advisories about the Revised Network Map and virtual public meetings.

- October 12, 2022—notice about the November 2 meeting and the Revised Network Map
- October 26, 2022—reminder about the November 2 meeting
- November 3, 2022—notice about the additional November 14 meeting

Newspaper display ads were placed in the following papers to advertise the November 2 virtual public meeting:

- *Sampan*—Chinese, October 21, 2022
- *Portuguese Times*—Portuguese, October 19, 2022
- *El Mundo*—Spanish, October 20, 2022
- *La Voz*—Spanish, October 27, 2022
- *Vocero Hispano*—Spanish, October 21, 2022

Email Blasts

The project team sent meeting announcements and reminder emails to numerous riders, community organizations, and other stakeholders. The team sent **5 e-blasts** to promote the November meetings and Revised Network Map. These e-blasts had an average open rate of 48 percent and an average click rate of 12 percent.

- **4,873** email subscribers in first email blast (October 12, 2022)
- **5,339** email subscribers in final email blast (November 10, 2022)

Table 16 BNRD Email Blasts—October and November 2022

Date Sent	Subject Line	Number of Recipients	Open Rate	Click Rate
10/12/2022	Better Bus Project: Bus Network Redesign Public Meeting on November 2	4,873	49%	13%
10/27/2022	Better Bus Project: Revised Bus Network Now Available	4,882	51%	22%
11/01/2022	Better Bus Project: Reminder Public Meeting on Wednesday, November 2 at 6:00 PM	4,896	46%	7%
11/03/2022	Better Bus Project: Additional Public Meeting on Monday, November 14 at 6:00 PM	5,336	49%	8%
11/10/2022	Better Bus Project REMINDER: Additional Public Meeting on Monday, November 14 at 6:00 PM	5,339	48%	9%

External Task Force

The project team assembled an External Task Force (ETF), made up of elected officials, municipal partners, institutions, representatives from advocacy organizations, and other stakeholders in order to provide project updates and share information, solicit feedback, and answer questions about Bus Network Redesign. The ETF met periodically throughout the span of the project, for a total of 15 meetings.

Table 17 Meetings of the External Task Force

Meeting #	Date	Format
1	May 10, 2019	In-person
2	June 13, 2019	In-person
3	August 8, 2019	In-person
4	September 25, 2019	In-person
5	December 2, 2019	In-person
6	February 13, 2020	In-person
7	June 25, 2020	Virtual
8	November 20, 2020	Virtual
9	July 28, 2020	Virtual
10	March 31, 2021	Virtual
11	May 6, 2021	Virtual
12	July 27, 2021	Virtual

Meeting #	Date	Format
13	September 22, 2021	Virtual
14	April 13, 2022	Virtual
15	October 26, 2022	Virtual

Fare & Service Equity Analyses

The Boston Region Metropolitan Planning Organization (MPO)'s Central Transportation Planning Staff (CTPS) conducted equity analyses on the BNRD changes, which meet the MBTA's Federal civil rights obligations to analyze service changes and any fare impacts that may occur from mode shift, for any disparate impacts on minority riders or disproportionate burdens on low-income riders. Results of these analyses were presented at a virtual public meeting on December 8, 2022, before being presented to the MBTA Board of Directors for discussion and a vote at the December 15, 2022 Board meeting. American Sign Language (ASL), Spanish, and Mandarin interpretation and Closed Captioning in English were provided at this meeting. There were 91 attendees and 57 comments received.

The Title VI Equity Analysis is summarized in Section 5 and can be read in full on the BNRD project website [here](#).

Outreach

Traditional Media

The MBTA issued media advisories about the Revised Network Map and virtual public meetings.

- November 17, 2022—Notice about the December 8 meeting
- December 1, 2022—Reminder about the December 8 meeting

Email Blasts

The project team sent meeting announcements and reminder emails to numerous riders, community organizations, and other stakeholders. The team sent **2 e-blasts** to promote the Fare & Service Equity Analysis meeting. The e-blasts had an average open rate of 50 percent and an average click rate of 4.5 percent.

- **5,541** email subscribers in first email blast (November 11, 2022)
- **5,538** email subscribers in final email blast (December 6, 2022)

Date Sent	Subject Line	Number of Recipients	Open Rate	Click Rate
11/17/2022	Better Bus Project: Bus Network Redesign Equity Analyses Virtual Public Meeting on December 8	5,541	49%	5%
12/06/2022	Better Bus Project REMINDER: Bus Network Redesign Equity Analysis Virtual Public Meeting on December 8	5,538	51%	4%

5 The MBTA's Future Bus Network

This section describes the changes made between the draft and final network and shows how the redesigned bus network achieves the project goals described in Section 2.

Integrating Public Feedback

The May 2022 draft network was developed based on quantitative travel data and service planner knowledge of the region. However, that data does not represent riders' lived experiences of the bus network and how it relates to other aspects of their lives, including housing, employment, medical appointments, or other critical reasons to travel.

Therefore, the MBTA made a concerted effort to balance the quantitative data with personal, qualitative input from a wide variety of voices through a series of public meetings, outreach events, and meetings with public and local officials (see Section 4 for more details). In addition, the MBTA sought to align the network plan with other upcoming developments, planning efforts, and infrastructure projects under design or construction by its municipal partners (see Section 3 for more detail).

20,000+ COMMENTS

from stakeholders were used to incorporate perspectives and priorities and priorities of system users and community members into the Revised Network Map.

Through public feedback activities, over 20,000 comments were received from different stakeholders. The project team organized this feedback into a comprehensive database of responses. As discussed in Section 4, these responses were tagged by source, route, neighborhood, attitude, and topics covered in each response.

The comment tags and detailed feedback were reviewed and summarized for each municipality and Boston neighborhood. These summaries analyzed the level of support from commenters for the draft bus network proposal in each municipality and neighborhood, identified frequently-appearing topics in the comments, and provided key takeaways from the open-ended feedback. The key takeaways focused on routes or locations where public comments indicated opposition to change, such as the shortening of a route from a key destination or the relocation of a route from its current street, or requested other adjustments, such as increased frequencies or extensions to a key destination not currently served by a route.

These summaries were used by the MBTA Service Planning team to inform the next round of adjustments. In preparing the Revised Network Map, the MBTA made it a priority to consider the “bus’s-eye view,” the perspective of people (both riders and operators) who traveled the route frequently.

Different types of feedback were incorporated into the revision process in a few different ways:

- **Letters from elected officials or municipal representatives** were given special consideration, reflecting their nature as important consolidations of local feedback. Issues noted in these letters highlighted or emphasized feedback that was also received through other avenues. While not all feedback from these letters were incorporated into the final map, they helped the Service Planning team combine and prioritize competing visions and needs in local areas.
- The **comment database** was provided to the Service Planning team, who were tasked with reading all the comments to understand where the public wanted changes to be made. This dashboard was useful for identifying which types of comments and which geographies contributed the largest number of comments. The Service Planning team used this feedback in internal staff workshops to inform the revisions to the map.
- **Bus operator and operations department feedback** was crucial for determining the feasibility of operating the proposed network and identifying implementation issues, including highlighting turns in a proposed route that a bus driver would not be able to execute safely, or identifying streets that were narrow enough to cause a risk of drivers striking parked cars if they drove along them. This feedback included a series of virtual meetings with senior representatives from various relevant departments, including Bus Operations supervisors and staff from Training, Safety, and Systemwide Accessibility. In-person meetings were held at bus garages throughout

the system to collect direct input from operators. This feedback included concerns about route length and its impact on reliability and operator schedules, conditions at layover facilities related to restroom access and operator comfort, and the presence of appropriate layover and bus turnaround space.

Revising Routes

With all the qualitative feedback and quantitative metrics in hand and in mind, the Service Planning team conducted a series of work sessions in early August 2022 to identify the revisions that needed be made to the draft network. In these sessions, service planners proposed ways to revise the network based on the feedback received. These sessions were used to weigh and debate the merits of different proposals, consider the tradeoffs between different options, and review analyses about the implications on ridership and service hours of potential changes. For example, the Service Planning team reviewed the Vehicle Revenue Hour (VRH) metric to assess how much service was being assigned to each neighborhood and municipality to ensure that service was being increased in priority areas for equity populations.¹⁶ Written feedback was used to ensure planners had a full understanding of key needs in each and every neighborhood.

During this revision process, many discussions centered on tradeoffs between different options given the resource constraints set for the redesigned network. The VRH implications of each option were considered. Throughout, the network impacts of changes to individual routes were considered. In one example, a change to one route in Burlington impacted a total of eight routes in the area that were all intertwined.

Incorporating feedback from people both inside and outside of the MBTA allowed the project team to gain the perspective of people who travel the routes frequently, offering a “bus’s-eye view” of operations as well as a customer’s perspective of using the system and moving between modes. These perspectives encouraged the project team to revert route changes to existing service in order to maintain critical functionality in bus operations or important connection points for customer access.

For example, some routes in the draft network had been designed to feed into the rapid-transit network at new locations. By providing these connections to the rapid transit network, the MBTA assumed that service accessibility would improve for riders, allowing them access to the entire rapid-transit network. However, feedback from riders often pointed out that the transfer points to the rapid transit stations were not easily navigable

¹⁶ Vehicle Revenue Hours measure the hours in which a transit vehicle is accessible to the public for transportation services, i.e., collecting revenue from riders when they board and pay their fares.

for people with mobility challenges—they relied on exposed stairways that could get slippery during the winter, or they required a long walk between the bus stop and the rapid transit station entrance. As a result, making the transfer would be more difficult for many riders, and they did not perceive this as a meaningful improvement to service.

Changes were made to 85 of the 133 proposed routes in the May 2022 draft Bus Network. These changes included new route direction and layout, restoration of existing routes, addition or subtraction of routes, extensions of routes, and modifications to frequency or span of service.

A total of 85 of the 133 routes were changed between the Draft and Final versions of the BNRD network.

Changes were made for five primary reasons:

- To respond to public feedback received on the draft bus network proposal;
- To provide better connections to medical facilities, senior centers, and other destinations, or at the request of municipalities;
- To reduce walk distances for seniors and other riders and in locations with challenging topography;
- To preserve existing one-seat rides to many destinations; and,
- To balance resources and stay within the limit of buses available during peak times and within the overall service limit of 25 percent more service above the existing network.

Table 18 summarizes the changes made for the different MBTA routes across the network.

Table 18 MBTA Route Adjustments

Route Adjustment Type	Impacted Routes
Restoration of existing routes to their current routing (in part or in whole)	14, 17, 26, 29, 34E, T39, 44, 45, T47, 55, 67, 74, 87, 89, 100, 131, 134, 201, 202, 210, 215, 230, 236, 238, 240, 354, 429, 451, 505
Rerouting to provide better connections to medical facilities, senior housing, and other destinations, or at the request of municipalities	T8, 11, T12, 18, 42, 53, 54, 59, 62, 64, 76, 83, 95, 96, 99, T101, T104, 105, 106, 108, 112, 119, 120, 211

Route Adjustment Type	Impacted Routes
Routes added to the Revised Bus Network that were not in the May 2022 draft	41, T47, 56, 58, 65, 80, 85, 113
Frequency or span adjustments (but not route changes)	30, 52, 78, 132, 216, 225, 226, 245, 435, 504, SL2
Routes that were included in the May 2022 draft but are not in the Revised Bus Network	20, 70, 94, 133, 237, 350

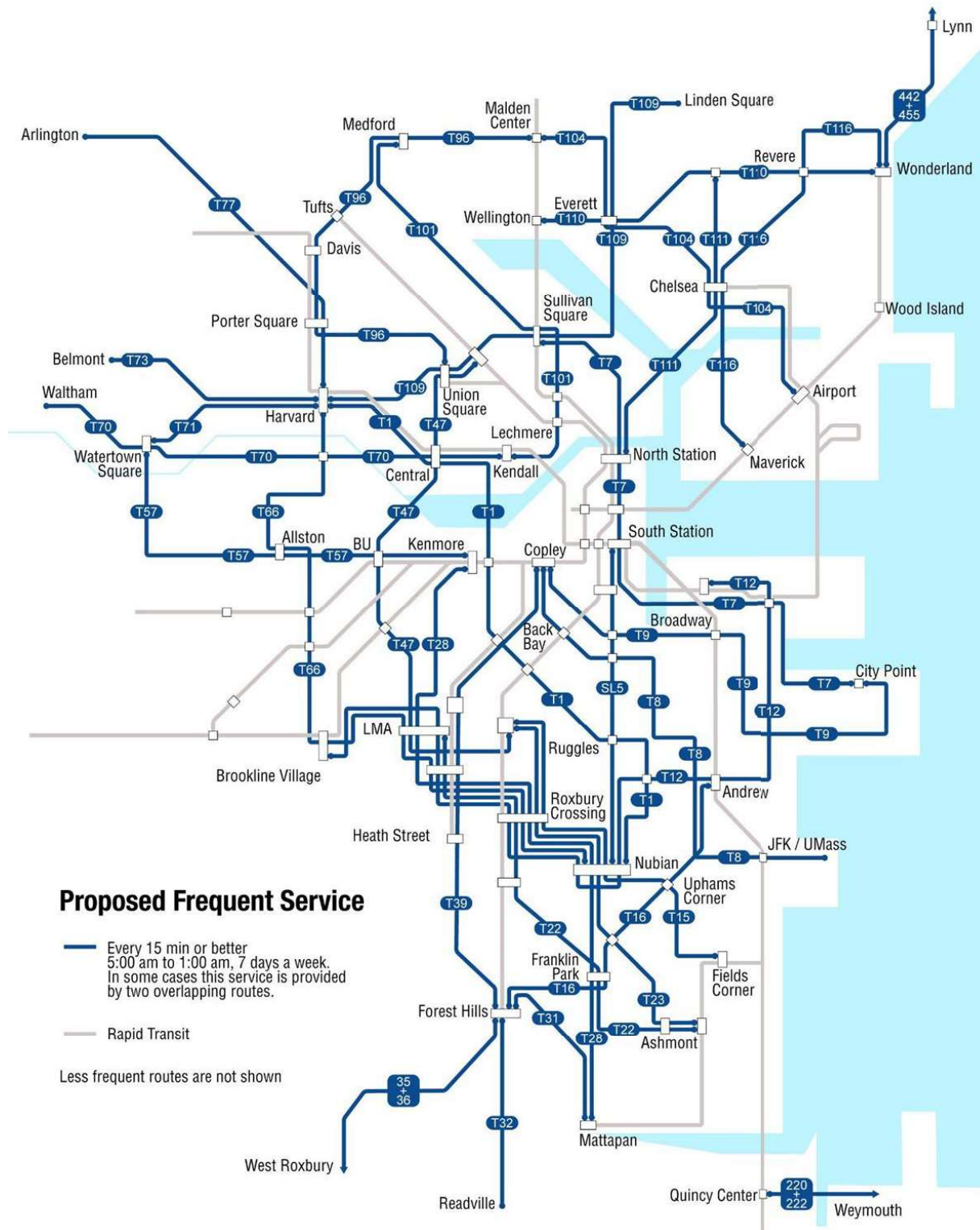
The Revised Network Map

In the Revised Network Map, which was published in October 2022 and approved by the MBTA Board of Directors on November 17, 2022, 30 routes will receive high-frequency service—defined as buses arriving every 15 minutes or better all day, seven days per week. Figure 40 shows the revised high-frequency network map. Highlights include:

- The establishment of high-frequency routes in Everett, Lynn, Medford, Somerville, South Boston, West Roxbury, Medford, and Waltham.
- High-frequency service between North Station and South Station.
- The extension of high-frequency service to the Seaport District, Kendall Square, and JFK/UMass.

Several areas with existing high-frequency routes also see an increase in the number of routes under the Revised Network Map, including Chelsea (increasing from two to three), Forest Hills (increasing from two to five), and the Longwood Medical Area (increasing from two to five).

Figure 40 Revised High-Frequency Bus Service Network Map

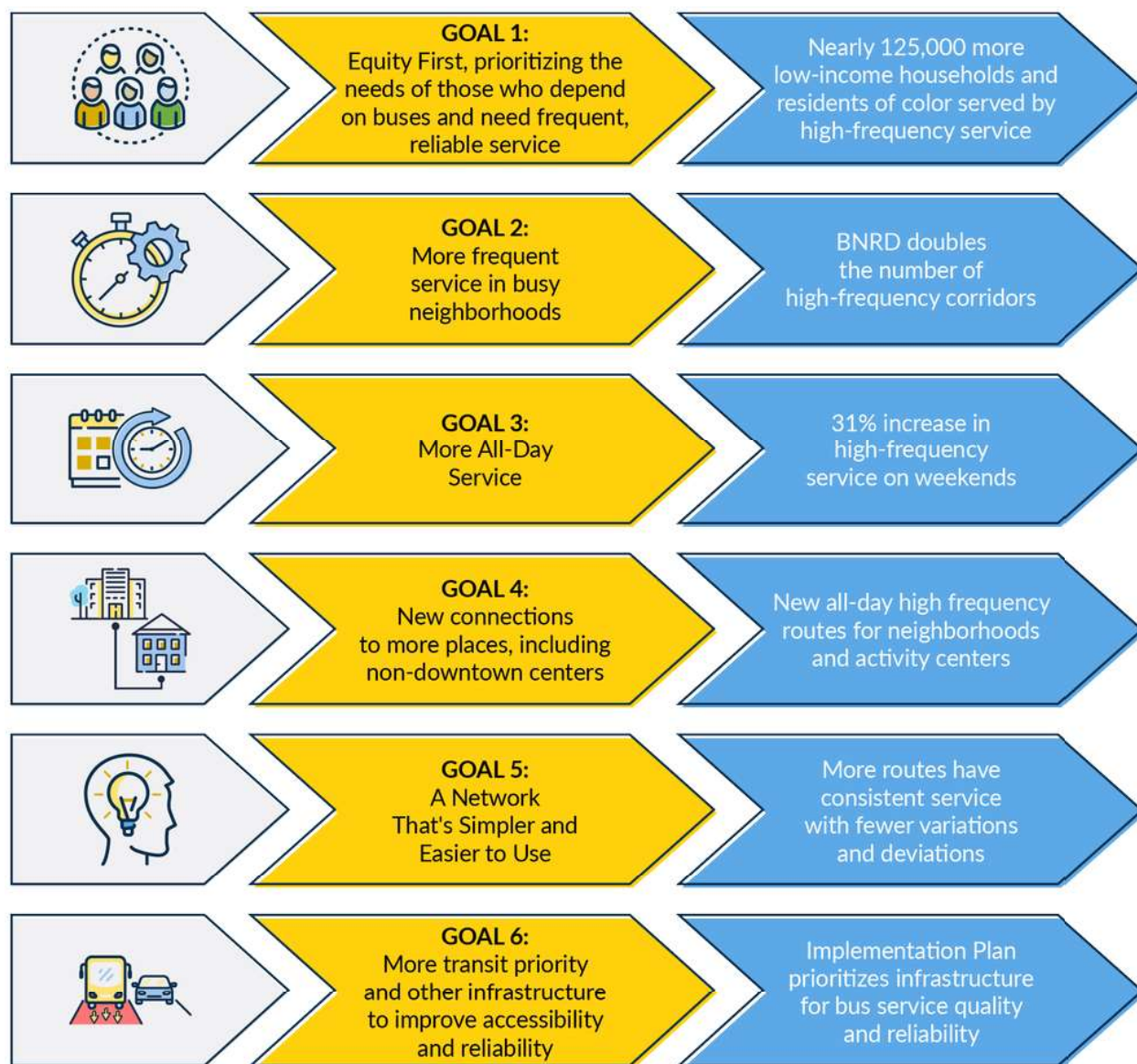


The Revised Bus Network: How It Has Changed from Today's Network and Achieved the Project Goals

The Revised Bus Network will not only increase service for residents of the Greater Boston area and make service more equitable, it will also make this service easier to use and understand. Service in the redesigned network will cover more of the region and provide transit access to more low-income households and residents of color. Tens of thousands of additional people will receive access to high-frequency service, with buses arriving every 15 minutes or better all day, seven days per week. The redesigned network will increase access to key destinations, including employment districts and medical, cultural, and educational centers.

The diverse array of destinations connected to the network means that the MBTA bus system will be more effective as a travel mode for all types of trips—not just work trips on a 9-to-5 commute pattern. With less variation in schedules and service span throughout the week, it will be easier for riders to plan their trips.

Figure 41 BNRD Goals and Outcomes



While high-level ridership estimates were developed to calculate potential fare revenue of a redesigned bus network, maximizing ridership increase was not an explicit goal of bus network redesign. This represented a policy choice on the part of the MBTA to prioritize access to service and service availability in the project goals, instead of focusing solely on ridership goals. Choosing to focus on ridership may have resulted in locating more service towards areas of existing high ridership, rather than directing service towards where it was needed but was not currently available.

To assess the outcomes of the BNRD effort, the MBTA evaluated the network using two primary performance metrics:

- **Coverage:** The number of people who are able to access the service. Coverage is measured by the number of residents who live within a quarter mile of a medium-frequency or low-frequency bus route or within a half mile of a high-frequency bus route. These distances represent the distance a person is generally willing to travel by foot, wheelchair, or other mobility assistance device to reach a bus stop. Coverage was evaluated for all residents, low-income households, and residents of color.
- **Vehicle Revenue Miles (VRM):** The amount of bus service provided within each municipality and Boston neighborhood. VRM represent the number of service miles in which a bus is in service to pick up and drop off riders across the day, i.e., the miles traveled when a bus can collect revenue.

For this analysis, VRM was measured at the municipality level, or at the neighborhood level within the City of Boston. A change in route design, span of service, or frequency generates a change in the number of VRM along the entire route. For each route, VRM was tracked for each neighborhood or municipality based on the distance that the route travels within the geographic borders of the neighborhood or municipality.

Assigning VRM to specific geographies facilitated the MBTA's efforts to balance service throughout the region while increasing service in neighborhoods with large numbers of lower-income and/or residents of color. Calculating VRM at the neighborhood- and municipality-level also facilitated the MBTA's outreach and engagement efforts, as it was easier to convey the impacts of the BNRD effort with representatives from neighborhoods and municipalities using these geographic assignments.

This methodology can underestimate service increases from a rider's perspective. Any rider who uses the bus network to travel to a different neighborhood or municipality benefits from the increase in service along the entire route and across the complete network, since that increase in service means less waiting time for both the outbound trip and the inbound trip. The reduction in wait time means the rider can reach a greater number of destinations under the new network in the same total travel time as compared to the previous network, further increasing the value of the service.

On average across the seven-day service span, more than 220,000 residents across the Greater Boston area gain access to high-frequency services, including 95,000 residents of color and 29,000 low-income households.

95,000 residents of color and 29,000 low-income households will have access to high-frequency service under the redesigned network.

Table 19 shows the change in service coverage across the MBTA service area, highlighting how residents (including low-income households and residents of color) in the Greater Boston area are impacted by the BNRD route changes. While the total amount of residents, low-income households, and residents of color with access to weekday service decreases by less than one percent, these losses are offset by coverage increases for Saturday and Sunday service. This change in service coverage allows the MBTA to achieve its goal of improving weekend service in order to enhance the bus network's ability to serve a broader array of trips, expanding beyond the historic focus on serving the 9-5 weekday commuter market.

Table 19 Change in Service Coverage in MBTA Service Area

Service Day	Group	Total Pop.	Current Pop. Covered	Current Percent Covered	BNRD Covered	BNRD Percent Covered	Change in Covered	Change in Percent Covered
Weekday	Residents	2,806,000	2,061,000	73.5%	2,050,000	73.1%	(11,000)	-0.4%
	Low-Income Households	348,000	282,000	81.1%	281,000	80.6%	(1,000)	-0.4%
	Residents of Color	1,033,000	872,000	84.4%	869,000	84.1%	(3,000)	-0.2%
Saturday	Residents	2,806,000	1,936,000	69.0%	1,991,000	71.0%	55,000	+2.0%
	Low-Income Households	348,000	270,000	77.6%	275,000	79.1%	5,000	+1.5%
	Residents of Color	1,033,000	841,000	77.6%	855,000	82.7%	14,000	+5.1%
Sunday	Residents	2,806,000	1,813,000	64.6%	1,980,000	70.6%	167,000	+5.9%
	Low-Income Households	348,000	258,000	74.0%	274,000	78.8%	16,000	+4.8%
	Residents of Color	1,033,000	805,000	77.9%	851,000	82.4%	46,000	+4.5%

Table 20 shows the change in high-frequency service coverage across the MBTA service area, highlighting how residents (including low-income households and residents of color) in the Greater Boston area are impacted by the BNRD route changes. High-frequency

55% of residents of color and 49% of low-income households will have access to high-frequency services under the redesigned network

coverage for all groups increases by at least five percent for weekday high-frequency service coverage. More than 140,000 residents gain access to high-frequency service on the weekdays. For Saturday high-frequency service, coverage increases by 12.5 percent for all residents, 14.1 percent for low-income households, and 15.0 percent for residents of color. More than 349,000 residents gain access to high-frequency service on Saturdays.

Across the span of service under the redesigned network, 55 percent of residents of color will have access to high-frequency service—up from 42 percent today. For low-income households, 49 percent will have access to high-frequency service, compared to 36 percent today.

Table 20 Change in High-Frequency Service Coverage in MBTA Service Area

Service Day	Group	Total Pop.	Current Pop. Covered	Current Percent Covered	BNRD Covered	BNRD Percent Covered	Change in Covered	Change in Percent Covered
Weekday	Residents	2,806,000	994,000	35.4%	1,136,000	40.5%	142,000	+5.1%
	Low-Income Households	348,000	152,000	43.6%	170,000	48.7%	18,000	+5.1%
	Residents of Color	1,033,000	506,000	49.0%	565,000	54.7%	59,000	+5.7%
Saturday	Residents	2,806,000	794,000	28.3%	1,143,000	40.7%	349,000	+12.5%
	Low-Income Households	348,000	124,000	35.7%	173,000	49.8%	49,000	+14.1%
	Residents of Color	1,033,000	423,000	40.9%	578,000	55.9%	155,000	+15.0%
Sunday	Residents	2,806,000	655,000	23.3%	1,141,000	40.7%	486,000	+17.3%
	Low-Income Households	348,000	105,000	30.0%	173,000	49.6%	68,000	+19.6%
	Residents of Color	1,033,000	360,000	34.9%	577,000	55.8%	217,000	+21.0%

Table 21 shows the change in daily VRM within the MBTA service area, comparing the draft and final BNRD networks to summer 2019 levels for the four service profiles: Weekday high-frequency, Weekday medium-/low-frequency, Weekend high-frequency,

and Weekend medium-/low-frequency.¹⁷ Summer 2019 levels are taken as a pre-BNRD benchmark to account for the disruptions and service loss that occurred in 2020 and 2021 brought on by the COVID-19 pandemic and related challenges.

While the BNRD effort increased total service by 25 percent, this aggregated increase reflects an increase in Vehicle Revenue Hours (VRH). Changes in VRM can be higher than the change in VRH since route speed and structure can vary across the network. Differences in route design and bus travel speeds may result in situations in which VRH changes do not perfectly correlate with VRM changes.

Overall, service levels increase by 26 percent on Weekday high-frequency routes, by 35 percent on Weekday medium- and low-frequency routes, by 31 percent on Weekend high-frequency routes, and by 19 percent on Weekend medium- and low-frequency routes, compared to their respective summer 2019 service levels. The higher increase on Weekday medium- and low-frequency routes demonstrates the MBTA's commitment to expand all-day service in order to more effectively serve trips that occur outside of the 9-to-5 travel period. Additionally, the higher increase on Weekend high-frequency service demonstrates the MBTA's commitment to reduce variation in service between weekdays and weekends by maintaining similar service frequencies on weekends. This increase will allow the MBTA to continue to serve as an efficient mode of travel for riders, seven days per week.

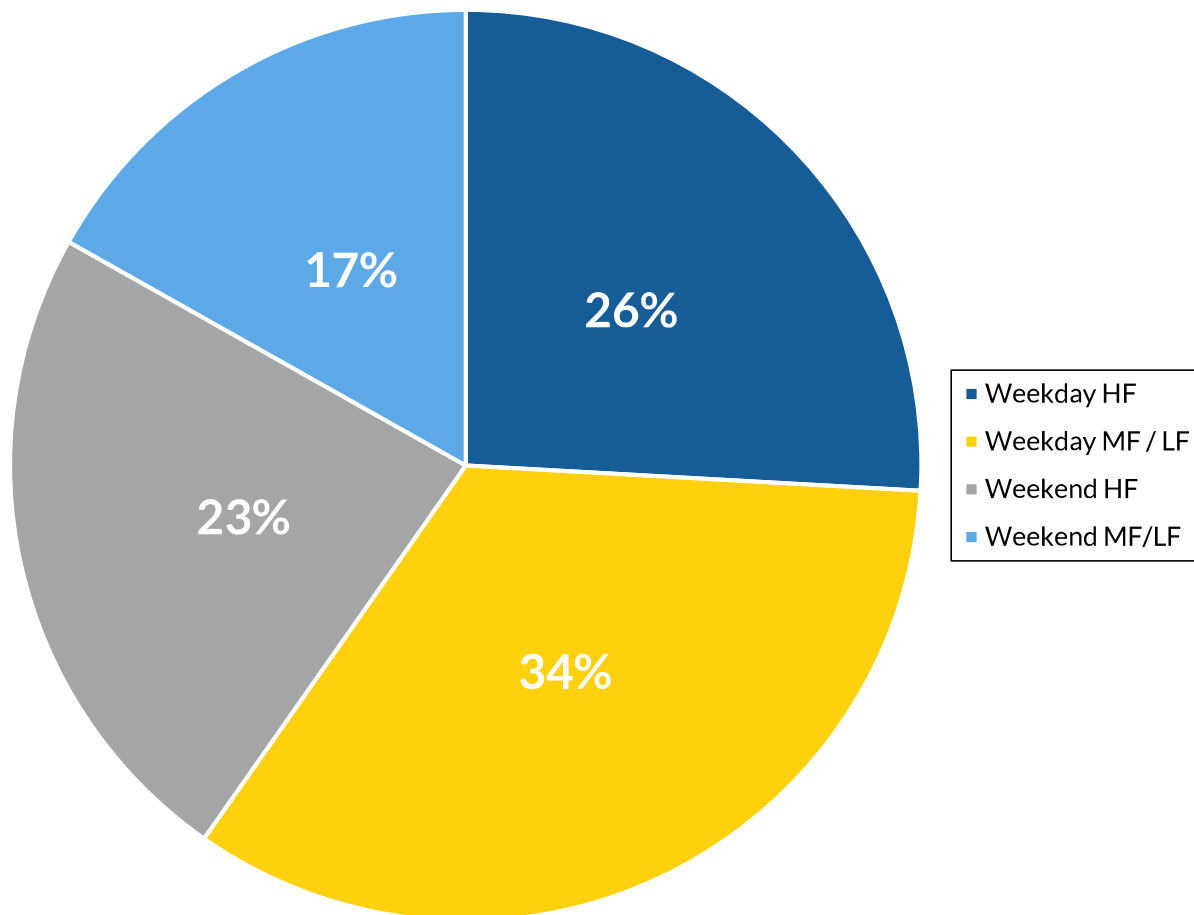
¹⁷ Weekend service statistics represent the service levels for Saturday.

Table 21 Change in Daily VRM in MBTA Service Area

Day of Service	Type of Service	Summer 2019 Daily VRM	Final BNRD Network Proposal Daily VRM	Percent Change, Summer 2019–Final BNRD Network
Weekday	High-Frequency	34,300	43,300	+26.3%
	Medium- and Low-Frequency	34,200	46,000	+34.5%
	Total	68,500	89,200	+30.4%
Weekend	High-Frequency	26,200	34,300	+31.2%
	Medium- and Low-Frequency	31,500	37,400	+18.6%
	Total	57,700	71,700	+24.3%

Figure 42 shows the daily VRM increases for each of the four service profiles as a share of the total service increase under BNRD. As with the percentage increases from their baseline services, the distribution of total service increase across the four service profiles demonstrates how the MBTA has achieved its goals for BNRD. Although Weekday high-frequency service receives a substantial increase, Weekday medium-frequency and low-frequency services receive the largest share of VRM increases to better balance resources beyond high-frequency corridors and improve service throughout the network. The relative balance between high-frequency service on Weekdays and Weekends similarly shows the MBTA's effort to reduce variation in service between weekdays and weekends and meet a wider array of travel needs on weekends.

Figure 42 Daily MBTA VRM Share of Increases by Service Type



Equity Analysis Results for the Redesigned Network

As required by Federal regulations, a transit agency that changes the location, frequency, or span of service of its transit routes must conduct an equity analysis of the changes. The purpose of this equity analysis is to determine if the changes have a disparate impact or disproportionate burden on low-income and minority populations who live within the service areas of the affected routes. Specifically, the equity analysis must determine if riders in these protected population groups experience a loss of service or an increase in fare payment as a result of these changes greater than that experienced by non-protected populations. Because these standards were established under Title VI of the Civil Rights Act, this analysis is referred to as a Title VI Service and Fare Equity Analysis.

The Central Transportation Planning Staff (CTPS) of the Boston Region Metropolitan Planning Organization (MPO) conducted the Title VI analysis. This analysis consisted of twelve Federally-approved tests for service and fare equity that compare the impact of the change for protected groups and non-protected groups. Specifically, the ratio of impact for change of the protected group to the impact for change of the unprotected group is assessed for Vehicle Revenue Hours (VRH) and Route Length (measured in miles).

Each test establishes a threshold value for the assessed ratio for VRH and route length based on whether service increases or decreases. For VRH-based tests on BNRD impacts, a ratio below 0.8 indicates that the protected populations receive significantly less of the service increase than non-protected populations receive, since VRH is increasing throughout the network under BNRD. For Route Length-based tests on BNRD impacts, a ratio above 1.20 indicates that protected populations are experiencing longer routes than non-protected populations. Since BNRD is designed to simplify routes through consolidation into high-frequency routes and the removal of route deviations, longer routes would indicate less service adjustment from the existing network.

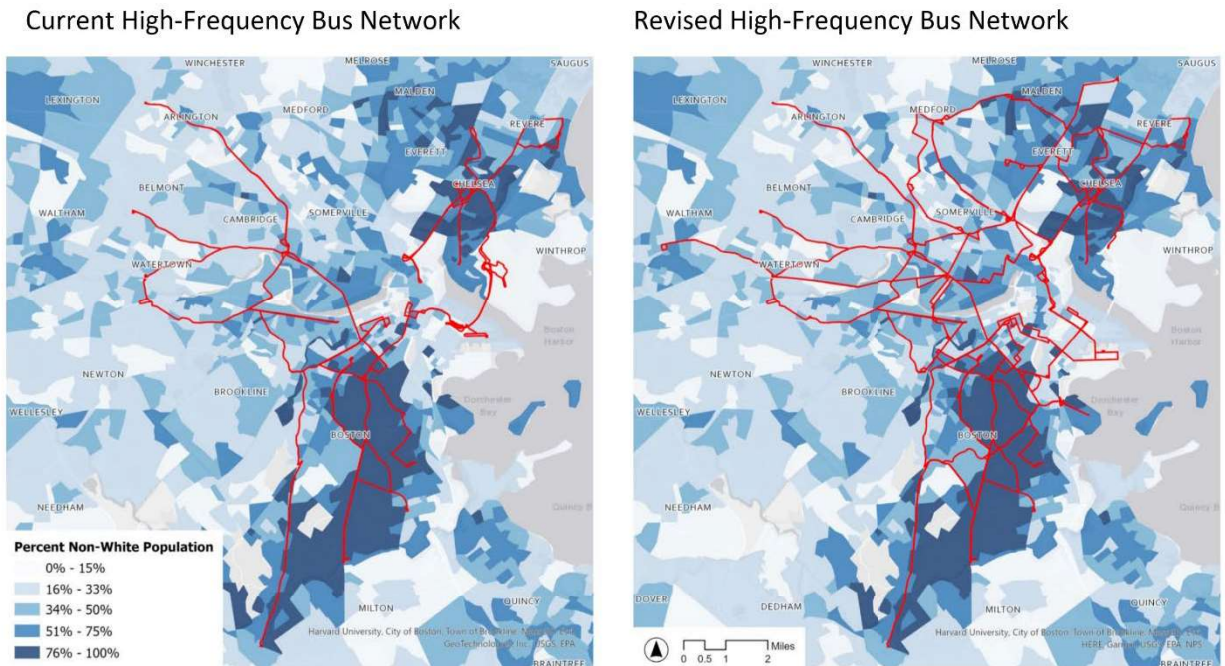
Overall, BNRD passed eleven of the twelve numerical tests, demonstrating that the MBTA was able to adhere to its goal of advancing equity throughout the bus network. Under the redesigned network, 50 percent of bus service (as measured by RVH) will reach minority populations, and 39 percent will reach low-income populations, compared to 47 percent and 38 percent, respectively, under the current network. The complete Title VI analysis can be viewed on the MBTA Bus Network website [here](#).¹⁸

Under the redesigned network, 50% of bus service will reach minority populations and 39% will reach low-income populations.

Figure 43 shows how access to high-frequency service changes for non-white populations, as measured by percentage of total population, changes between the current network and the revised network.

¹⁸ 2022 MBTA Bus Network Redesign Title VI Analysis. https://cdn.mbta.com/sites/default/files/2022-12/2022-12_bus-network-redesign-title-vi-analysis.pdf.

Figure 43 Changes in Access to High-Frequency Bus Service for Non-White Populations by Area



The MBTA Board of Directors accepted the results of the Title VI analysis at a Board meeting on December 15, 2022.

Section 6 discusses how the MBTA will implement the BNRD over a five-year phase to deliver meaningful improvement in service quality and system performance for riders throughout the Greater Boston area.

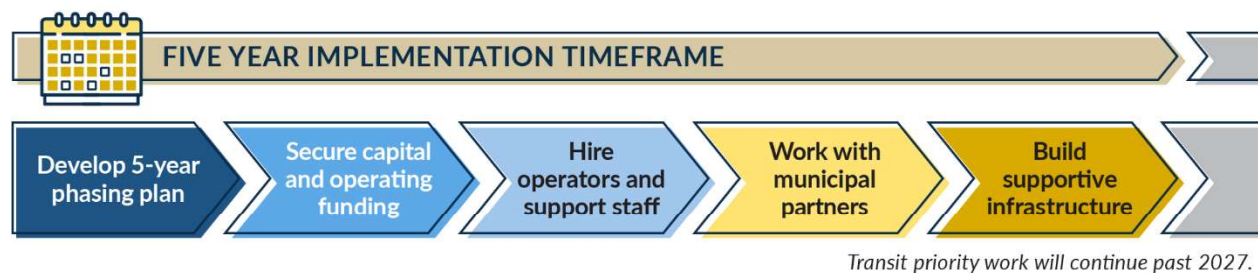
6 From Planning to Implementation

Bringing the Bus Network Redesign plan to actual service on the streets will be a complex undertaking. This section describes the schedule, phasing, and prerequisites needed for fully implementing the redesigned bus network.

Schedule for Implementation

The MBTA has identified a five-year timeframe for implementation, beginning in 2023, as illustrated in Figure 44.

Figure 44 Schedule For Implementation



A five-year timeframe for implementation is needed for a variety of reasons.

Hiring

It will take time to hire all the bus operators needed to provide the increased service called for in the BNRD plan. The 25 percent service increase will require about 440 new bus operators over pre-COVID service levels; in addition, the MBTA currently has over 300 vacant positions for bus operators. The MBTA is aggressively hiring both bus operators and other support staff, but it will require multiple years to reach the required number.

Training

Operators are specifically trained to safely operate routes within their assigned area/district. By spreading out each change over multiple garages, each garage's workforce can maintain existing operations while integrating a selected number of changed routes into the operators' training programs. This training structure allows operators to become familiar with the new routes and learn to navigate them safely and reliably before training for additional routes.

BNRD Implementation Staffing

BNRD is the most significant change to the region's bus system in decades. Implementing this task will require a dedicated Implementation Team within the MBTA's Bus Transformation Office, with staff skilled in project management, customer communications, municipal coordination, service planning, and bus operations. This team will be responsible for working with other MBTA staff—as well as transportation staff in municipal departments—to schedule route changes for implementation and build new schedules, upgrade and build new infrastructure, communicate with stakeholders, and manage the implementation process. It will be necessary to coordinate and bolster existing staff expertise with a dedicated BNRD Implementation Team, and assembling this team will take time.

Communication

The changes that BNRD will bring are unprecedented in scale at the MBTA. Time is needed to communicate with everyone—from riders and municipal partners to internal operations staff—through all channels. The MBTA will need to craft detailed, tailored messages on how and where route changes will be implemented and what these changes will mean for riders, community partners, and municipalities. This communication needs to be rolled out thoughtfully, carefully, and comprehensively.

Capital Investment

BNRD requires approximately \$500 million in capital improvements, which cannot be constructed all at once. These improvements include roadway and intersection improvements, berthing and layover facilities, transit priority lanes, new accessible bus stops, and signage changes at bus stops and transit stations. Some of these projects will require multiple years of coordination, outreach, design, and construction to ensure that they are implemented safely. Municipalities own the sidewalks on which bus stops are placed and most streets that need bus lanes and transit priority; the MBTA will coordinate with their municipal partners on how, where, and when many of these capital improvements are installed. Some BNRD route changes are predicated on these construction projects to enable the routes and the riders who use them to benefit from the resulting operational improvements.

The *BNRD Transit Priority Plan* and *Transit Priority Toolkit*, which the MBTA is currently developing, will help determine what investments should be made in what locations and how these investments should be prioritized.

Phasing

Implementation phasing will follow the original goals of BNRD:

- Putting equity first.
- Making a network that is simple and easy to use.
- Creating new connections to more places
- Improving reliability and accessibility.

Phasing must consider assessing project readiness, managing the customer experience in intermediate phases, and maintaining network connectivity throughout the implementation period.

Key considerations in selecting bus routes for implementation in phases will include:

Equity

Service changes that provide more service to those who depend on buses and need frequent, reliable service will be prioritized.

Project Readiness

Some service changes will require capital investment: bus projects are often complex, involving municipal, public, and interagency coordination with construction in areas not owned by the MBTA. The MBTA should initiate these projects as soon as possible, but it may be several years before all are completed.

Maintaining Network Connectivity

Phasing must be mindful of intermediate network connectivity. Some changes, such as shortening one route and lengthening another in its place, are obvious pairings and should be done in tandem. The MBTA will endeavor to reasonably maintain connections with enough service capacity to accommodate anticipated trips and minimize interim conditions where trips are considerably more challenging or circuitous than before.

Balancing Adds and Takes

When possible, service levels or hours of service within a specific geographic area or corridor should not significantly exceed or fall below the levels of service provided in Winter 2023 and in the end-state of BNRD. When developing phasing plans, the MBTA should avoid intermediate states where service levels are temporarily higher or lower, only to be changed later. Service planners will work to add new service in coordination with removing old services.

Simple and Easy to Use

Throughout implementation, customer communications and permanent signage will need to stay up-to-date and easy to understand for riders to understand the changes and navigate the new network.

Signage

Phased implementation means that service at many bus stops will change more than once within the next five years. Signage will need to be accurate throughout the implementation process, meaning that some signs may be altered multiple times to reflect service provided in that implementation phase. Upon completion of BNRD implementation, all MBTA bus stop signs will need to be in the current style, in a state of good repair, and have accurate information.

Prerequisites for Full Implementation

To accomplish full implementation of BNRD, several key items will need to be in place.

Operating Funds

In Fiscal Year 2023, the MBTA will initiate its first phase of BNRD implementation with a 25 percent increase in the bus operating budget from FY22 to accommodate additional labor, materials, fuel, and services. Table 22 presents the estimated increase in annual operating budgets that will be required to implement BNRD for each of the fiscal years under the five-year phased implementation window. This budget is subject to change as external factors, including supply chain pressures on materials and fluctuations in fuel costs, change over time.

Table 22 Estimated Increase in MBTA Bus Operating Budgets to Implement BNRD, FY23-FY28

Category	FY23	FY24	FY25	FY26	FY27	FY28
Bus Transportation	\$10,660,000	\$20,570,000	\$33,020,000	\$46,110,000	\$59,160,000	\$71,830,000
Maintenance	\$4,180,000	\$8,000,000	\$12,800,000	\$17,830,000	\$22,810,000	\$28,390,000
Training	\$190,000	\$360,000	\$570,000	\$800,000	\$1,030,000	\$1,250,000
Administration & Support	\$690,000	\$1,320,000	\$2,110,000	\$2,950,000	\$3,790,000	\$4,640,000
TOTAL	\$15,710,000	\$30,250,000	\$48,510,000	\$67,690,000	\$86,790,000	\$106,110,000

This budget increase will enable the MBTA to increase its headcount over its pre-COVID staffing levels to operate, maintain, and manage the higher number of buses needed to meet a 25 percent network-wide increase in service. Table 23 shows the increase in headcount across these MBTA departments.

Table 23 MBTA Bus-Related Headcount Changes to Implement BNRD

Category	Pre-COVID Headcount	Post-BNRD Headcount	Change in Headcount
Bus Transportation ¹	1,949	2,436	+487
Maintenance	402	506	+104
Training	58	64	+6
Administration & Support	87	109	+22
TOTAL	2,496	3,115	+619

¹ Includes Bus Operators, plus some operations support staff.

Capital Funds

As of 2022, it is estimated that BNRD implementation will require approximately \$500 million in capital investment over several years. It is expected that only a portion of this will be spent by FY2028, and the rest will be spent in subsequent years. Capital projects requiring completion beyond FY2028 will include significant, time-intensive transit priority investments such as center-running bus lanes to improve travel times and reliability throughout the bus network. This cost is subject to change as project implementation moves forward. Items in this estimate include (but are not limited to):

Bus Stop Installation

- Construct new bus stops
- Install shelters at new bus stops
- Lengthen bus stops to accommodate 60' buses
- Shut down old bus stops and remove infrastructure

Busway Modifications

- Construct busway and on-street modifications to accommodate increased berthing and layover needs¹⁹

Roadway and Intersection Improvements and Adjustments

- Advance capital projects to allow new or safer travel patterns throughout the region's street network

Transit Priority

- Install center-running bus lanes
- Construct side-running bus lanes
- Implement Transit Signal Priority traffic systems

Signage

- Install new bus stop signs
- Produce decals for signage adjustments
- Update maps and signs in stations, busways, railcars, and buses

Operator Restroom Facilities

- Identify and construct additional restroom facilities to reasonably accommodate operator needs throughout the network

¹⁹ These projects will greatly inform implementation phasing.

Communications

- Keep website up-to-date
- Conduct additional public outreach

Bus Lane Enforcement

- Pending bus lane enforcement legislation, add bus-mounted cameras to the MBTA bus fleet

Bus Operators

A 25 percent service increase over pre-COVID levels will require a significant increase in bus operator headcount to simply meet pre-COVID levels, in addition to about 440 new bus operators. As of December 2022, the MBTA currently has over 300 vacant positions for bus operators. The MBTA is aggressively hiring bus operators and support staff but expects it will require multiple years to reach the numbers needed for full implementation of BNRD.

Transit Priority Projects

The MBTA has identified nearly 75 miles of roadway as candidates for transit priority measures, including bus lanes and transit signal priority. Automated bus lane enforcement would result in increased time savings and reliability on these facilities. The MBTA will continue to coordinate with roadway owners to identify, prioritize, and design safe and effective transit priority measures throughout the network.

The *BNRD Transit Priority Plan* and *Transit Priority Toolkit* are both under development as of early 2023. These documents will contain more details on where investments in transit priority are warranted, and which investments and improvements would be most beneficial.

Fleet and Facilities Program

The Fleet and Facilities Modernization program will modernize and electrify the MBTA's bus fleet, which is a key building block to implementing the Better Bus Project. The Fleet and Facilities Modernization program may have minor impacts on BNRD implementation phasing, but BNRD was designed to utilize and work within the MBTA's existing fleet size.

BNRD Implementation Team

BNRD provides the most significant change to the region's bus system in decades. Implementing this task will require staff skilled in project management, customer communications, municipal coordination, service planning, and bus operations. It will be

necessary to coordinate and bolster existing staff expertise with a dedicated BNRD implementation team.

The BNRD Implementation Team will work closely with other groups, including the MBTA Customer Experience, Systemwide Accessibility, Capital Delivery, and Service Planning departments to achieve a unified and successful outcome.

Communications Requirements of BNRD

The MBTA bus network serves hundreds of thousands of diverse riders each day, across dozens of municipalities. BNRD will require consistent, reliable, and various communication methods to reach existing and potential customers.

The MBTA will develop a *BNRD Outreach and Communications Plan*, which will detail needs, processes, and procedures for effective and consistent communication throughout the implementation process. Through this, it will create service change communication standards, which will establish common ways of communicating about service changes across all media and other channels to keep the public informed and knowledgeable about changes in a consistent manner.

Additional Information

To stay informed about the progress of BNRD, visit the [MBTA.com/BetterBus](https://www.mbta.com/betterbus) website, where you can sign up for email updates and find additional information on the current status of implementation.

For further details on the results of the redesign and the process to create it, refer to the following resources.

- The [Revised Network Regional Map](#)
- The [Revised Network Interactive Map](#)
- The [List of Changes](#) between current routes and the Revised Network Map
- The [Title VI Equity Analysis](#) report
- The Office of Performance Management and Innovation's post titled "[How We Used Data to Design an Equitable Bus Network](#)"



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